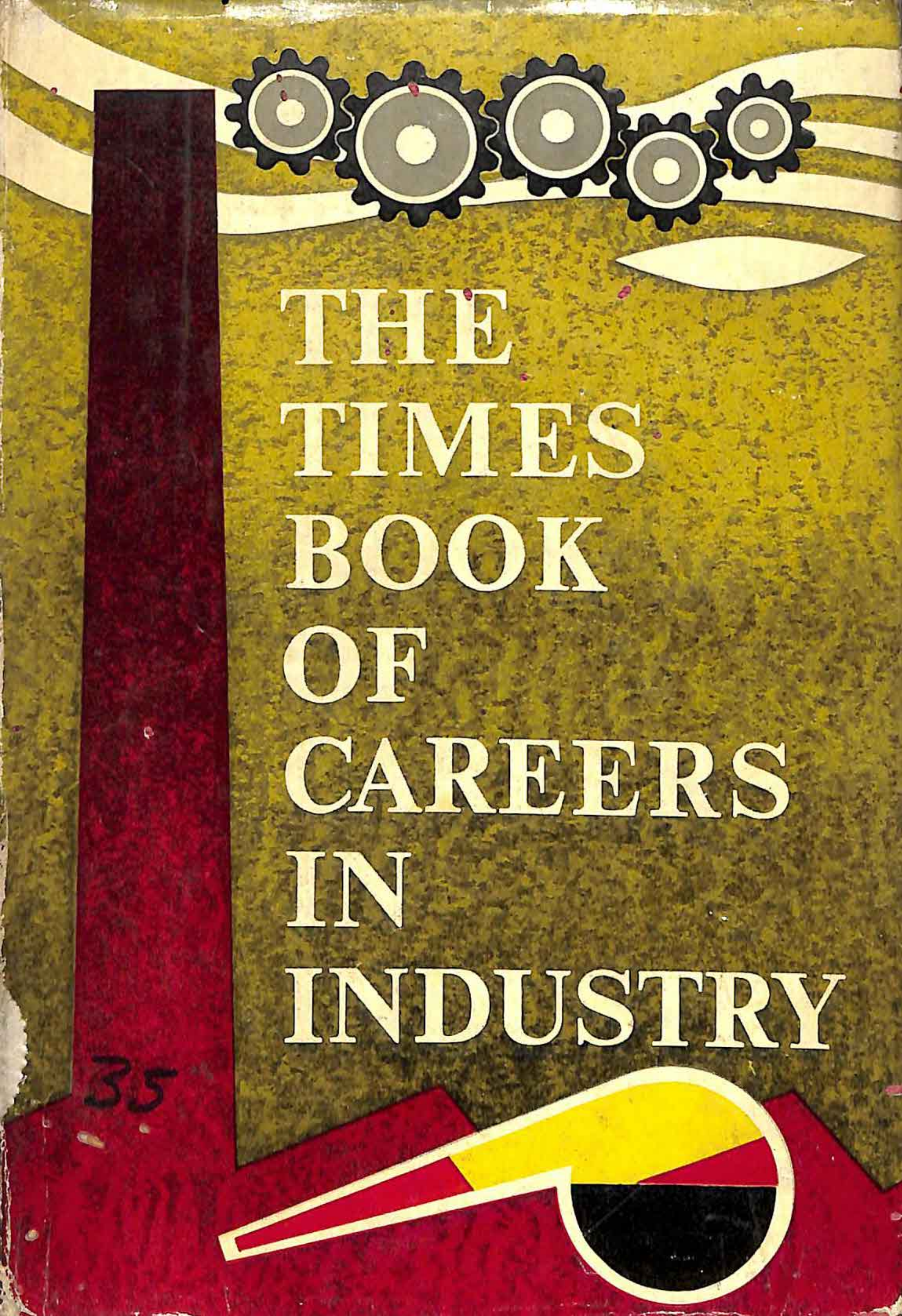

THE TIMES BOOK OF CAREERS IN INDUSTRY

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Here is a welcome guide to the complex business of choosing a career. Compiled from *The Times* supplement, it sets out to dispel some of the mystery surrounding that comprehensive, yet vague word, industry. Thirty-three articles written by experts point out the vast numbers of opportunities for young men and women whether they are school leavers or University graduates. The articles themselves are clear and concise, concentrating on essentials such as qualifications and methods of entry, training schemes, prospects of promotion and the general atmosphere of work in industry.

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CONTENTS

1. The new outlook 1
2. The choice of a career 5
R. A. Banks
3. Attractions of atomic energy 9
Sir Donald Perrott, K.B.E.
4. The world's need for oil 13
W. W. Evans
5. The exciting business of chemicals 17
Sir Miles Thomas, D.F.C., M.I.Mech.E., M.S.A.E.
6. Engineers & managers for the coal mines 22
J. O. Blair-Cunynghame, O.B.E., M.A.
7. Widening horizons in gas 26
Sir Harold Smith, K.B.E., D.L., M.I.C.E., M.Inst.GasE.
8. Careers in electricity supply 29
Sir Henry Self, K.C.B., K.C.M.G., M.Sc., Ph.D.
9. Building our lines of communication 35
Sir Godfrey Ince, G.C.B., B.Sc., LL.D.
10. The fascination of electronics 38
J. C. G. Gilbert, F.R.S.A., A.I.E.E.
11. The scope of electricity 43
A special correspondent
12. Iron & steel experts 46
C. H. T. Williams
13. Working with the newer metals 49
G. L. Bailey, C.B.E., M.Sc.
14. Mining metals abroad 52
B. W. Kerrigan
15. Training all kinds of mechanical engineers 56
H. G. Conway, M.A., M.I.Mech.E.
16. Engineering in nuclear research 62
J. R. V. Dolphin, C.B.E.

17. Building & civil engineering 66
Sir Richard Costain, C.B.E.

18. Crafts & careers in the shipyards 69
Robert W. Johnson

19. A career in the railways 74
Sir Landale Train, C.B.E., M.C., M.I.C.E.

20. Prospects in the motor industry 78
J. Wilson, J.P., B.Sc., B.Com., M.I.Mech.E.

21. New techniques for aircraft 84
H. W. Goodinge, A.R.Ae.S.

22. Variety in textiles 89
P. A. Holt, B.Sc.Tech.

23. Possibilities in plastics 94
J. N. Ratcliffe, A.C.I.S.

24. Diversity in the paper trade 98
H. A. Pawson

25. Craftsmen & chemists in the glassworks 103
Professor R. W. Douglas, D.Sc., F.Inst.P.

26. The appeal of pottery 107
Sir John Wedgwood, T.D., J.P.

27. The industrial designer 110
Sir Gordon Russell, C.B.E.

28. The retail trade transformed 113
James B. Jefferys, B.Sc.(Econ), Ph.D.

29. Jobs in food processing 117
R. S. Worth, C.B.E.

30. Selection for research establishments 121
A special correspondent

31. New fields for banking services 124
O. E. Wood, M.A., LL.B.

32. Qualities needed in insurance 126
Charles F. Trustam, M.A., F.I.A.

33. Learning the art of management 129
F. R. Livock, T.D.

Addresses and information 132

Index 141

PHOTOGRAPHS

Facing page

1. Work in progress on the site of Bradwell Nuclear Power Station. (*By courtesy of The Times*) 8
2. A boy at British Railways' Crewe works discusses his future. (*By courtesy of The Times*) 8
3. Analytical distillation in the laboratory at Stanlow Refinery. (*A Shell photograph*) 9
4. Operating the pressure-dipping device which indicates the level of butane in a Shell Motor Storage sphere. (*A Shell photograph*) 9
5. The iso-propyl alcohol plant at the Partington works of Petrochemicals Ltd. (*By courtesy of The Times*) 24
6. Growing cultures of micro-organisms for effluent disposal. (*Photographed by Maurice Broomfield, London. Reproduced by courtesy of the Gas Council*) 25
7. Trainees being shown how to set a ' Schwarz ' prop at Wigan Junction Colliery. (*By courtesy of the National Coal Board*) 25
8. An apprentice at a Turbine Control Valve. (*By courtesy of the Central Electricity Generating Board*) 40
9. Students at work in the instrument room at the Engineering School at Porthcurno. (*By courtesy of Cable & Wireless Ltd.*) 40
10. A senior apprentice helping to wind the stator of a 30 MW turbo-alternator for export. (*By courtesy of The English Electric Company Ltd.*) 41
11. Adjusting a television scanner in the research laboratory. (*By courtesy of Mullard Ltd.*) 56
12. An extrusion emerging from a die. (*By courtesy of the British Aluminium Company Ltd.*) 57
13. A 20 ton testing machine in the Fatigue Laboratory at Cambridge. (*Photograph and copyright by Henry Grant, London*) 57

1

THE NEW OUTLOOK

Though there exist pockets of quite heavy unemployment (the unemployed are, for the most part, those without craft or profession) the problem that faces the boy or his parents today is one of choosing rather than of finding a career. To this general statement there are exceptions. The arts graduate is in less urgent demand than his scientific fellow; but the careers open to the arts graduate are both many and good. It is with technical careers, however, that this Supplement is mostly concerned, and here perhaps the problem of selection is most acute. When, and how far, should one specialize? For how long should one stay at school? What are the merits of early entry on a career and can they ever outweigh the advantage of a full-time university education? Where should one seek advice?

The last question is the most easily answered. Between them, the careers master, the youth employment officer, the public schools and universities appointments boards provide a formidable battery of advice which industry all too eagerly supplements with lavish brochures. If the other questions are much more difficult, a general and fair answer can be given to them all. Let parents keep in frequent and familiar touch with the schools. Fortunately, too, industry is tending to hold general education in higher regard than it did. The best of firms are now among the hottest enemies of a too-early specialization. Only if newcomers, at whatever level of entry, are fundamentally well educated will they be able to absorb fully the mass of technical detail that industry requires them to digest in its training programmes. Thus the demands of industry and the normal wishes of parents are tending to coincide, and some of the choices to be made are less sharp than they once appeared.

14. An apprentice learns to operate a hydroptic jig borer. (*By courtesy of Joseph Lucas Ltd.*) 72
15. The construction of the London-Yorkshire Motorway being discussed in the planning office. (*By courtesy of The Times*) 73
16. An apprentice working on engine assembly lowers a cylinder head into position. (*By courtesy of Jaguar Cars Ltd.*) 80
17. Apprentices being shown how to install a fire warning light on a Comet. (*By courtesy of De Havilland Aircraft Company Ltd.*) 81
18. Apprentices in the British Railways School at Crewe. (*By courtesy of The Times*) 81
19. Production trainees watching the closing of one of the giant presses at the Tynemouth factory of Formica Ltd. (*By courtesy of The Times*) 96
20. A young textile designer examining the construction of a piece of cloth. (*By courtesy of The Cotton Board*) 97
21. A machine at Aylesford Paper Mills which produces paper up to the rate of 2,000 f.p.m. (*By courtesy of The Reed Paper Group*) 97
22. A girl printing with a silk screen at the School of Textile Design, Royal College of Art. (*By courtesy of The Times*) 112
23. Polishing the surface of flatware after it has been fired. (*By courtesy of Josiah Wedgwood & Sons Ltd.*) 112
24. Testing new growth substances on tomatoes. (*Copyright by John Topham Ltd., Sidcup, Kent*) 113
25. An aircraft model at the National Physical Laboratory being checked before a compressed air tunnel test. (*Copyright by National Physical Laboratory, Teddington, Middlesex*) 113

Between the higher sandwich course and the university degree there may, in time, be little to choose. Until some of the sandwich courses are more effectively organized—better tuition in the in-works period, proper arrangements for research in the advanced colleges, reasonable hostel accommodation and a social life are all urgently wanted—the advantage and the attraction will normally lie with the universities. But the higher sandwich course does lead to Dip. Tech. and to membership of professional institutions, and after the thirties are passed differences of approach will be much less apparent. For the father, and particularly one with two or three children to educate and perhaps hard pressed by the means test, the growth of entry to industry through a sandwich course has come as an enormous relief. That finance should determine this choice would perhaps, almost everywhere, be considered wrong. But the blunt fact is that it does.

British industry had good ground for complaint in the years before the war that it generally failed to get the best of the youths and men that came on the labour market. For graduates the attractions of the Civil Service, at home or in the Commonwealth, and of the professions (how they scrambled, then, to teach in the schools) were more than industry could match. Similarly, boys left the grammar schools already persuaded of the superior claims of white collar jobs. For many, industry was dirty, insecure and dull.

The fact that these sentiments were widespread was partly industry's fault. Its attempts to explain the opportunities it could offer were frequently inept, inadequate or lacking altogether. All this, as the Supplement proves in its own way, has changed.

But a simple shift in demand is not the most significant change. There are few jobs in modern industry for which a newcomer, at any age of entry, is qualified by formal education alone. In the pages that follow, industry is offering not only jobs but the opportunities to train for them; and, it should be added, in most instances in industry's time and at industry's expense. The trainings now offered as a matter of course are not primarily intended to be attractive bait, though a discerning youth will rate a good training scheme above a high starting salary when he is picking his first employer. There are two reasons more important than that. One is that the best of firms have come to see that they must provide for their requirements of skilled labour as systematically as for new plant and capital. The second is that the phenomenal growth of certain sciences, for example biochemistry, or of new technologies, such as chemical engineering, has widened immensely the gap between that basic knowledge which is all that can be taught at school or on a first degree course, and the mass of technical detail and practical skill which a man must acquire before he can become of real use to his employers.

This rate of growth of new knowledge and techniques is among industry's most serious problems. All too few firms are properly equipped to take advantage of the scientific papers that are available to them, from both sides of the Atlantic, in the English language. Those that make any sort of systematic search of German or Russian papers are fewer still. Even the best organized of firms are occasionally embarrassed when, for example, a sudden " declassification " decision releases pent-up papers on atomic energy to flood an already swiftly flowing stream.

In the past three years there has been a quite dramatic reshaping of education resources to meet such challenging advances. At the lowest level, the secondary modern schools have begun to shed their fears of examinations and in a number of areas school leaving certificates are helping to improve selection for apprenticeships. On the problems of apprenticeship itself the Carr Committee has recently reported, not as purposefully as most people would have wished, but clearly exposing the acute scarcity of apprenticeships that threatens us in the next two years. And a year ago the Association of British Chambers of Commerce launched a scheme for apprenticeship in commercial subjects.

For the independent and direct grant schools the Industrial Fund has been providing grants towards the cost of laboratories and equipment that will bring the average percentage of sixth formers reading science or mathematics to about 70. (Who is to teach in them is an unsolved problem.) In the higher reaches of technical education a course has been plotted by the 1956 White Paper. Already, following its lead, eight colleges have been designated in England and Wales as Colleges of Advanced Technology (as yet some are so in not much more than name) and the National Council of Technological Awards has created a new diploma of technology which the first batch of students took in summer 1958. Nor must we forget the Willis Jackson Committee which has made useful, and already implemented, suggestions on the staffing of technical colleges. At university level vigorous expansion continues (not without sporadic alarms) and there has been an encouraging growth in short post-graduate courses which can supplement basic studies of a first degree syllabus. In both buildings and scholarships industry has vastly increased its patronage.

All this makes a heartening story. The challenge of technological advance has been taken up more determinedly in the past three years than ever before. Comparisons with, for example, the Russian effort (though they are often unsoundly made) allow no thought of letting up the pace. Day release and sandwich courses produce a more easy-going routine than did night school and " London external ". Altogether too easy-going, some old hands are inclined to think. But they are wrong. The newer methods are more efficient, and so long as the broad path from bottom to top is open and uncluttered the competitors themselves will set a cracking pace.

2

THE CHOICE OF A CAREER

BY

R. A. Banks

PERSONNEL DIRECTOR, IMPERIAL CHEMICAL INDUSTRIES

In ancient Greece, whenever advice was sought about the future it was the custom to consult an oracle, the most famous being that in the Temple of Apollo at Delphi which the Greeks regarded as the centre of the earth. Here generals asked for guidance before their battles, politicians sought approval for proposed actions in affairs of state, and even private citizens inquired about personal matters such as marriage, wills and the careers of themselves or their children. Over the entrance to the temple was written " Know thyself ".

In deciding one's career it is still good counsel to begin with a knowledge of oneself—one's interests, aptitudes, tastes and capabilities. Equally important is an expert knowledge of the jobs available, but for both kinds of knowledge we need help and advice from others. Viewed from the distance of school or university, often without any first-hand experience, the problem of finding a job has never looked so easy; to select the right one has never been so difficult. To whom can the youth of today turn?

Most schools have recognized the partnership of masters or mistresses and parents in teaching knowledge of oneself, but neither have enough time or opportunity to be expert in knowledge of careers. Many schools have therefore appointed a careers master, usually a member of the staff with an interest in the world outside education and enough energy and enthusiasm to assume responsibilities over and above his normal teaching duties. His job is to coordinate all careers information obtained from outside bodies, such as the Youth Employment Service, Public Schools Appointments Bureau, and individual employers. Both he and the employers recognize the importance of personal contact, and his holidays often include visits to factories and other places of employment; his spare time is frequently spent in organizing brains trusts and lectures from old boys and would-be employers, and in giving individual advice to boys about specific careers. His post and its growth are typically British—rarely a specialist by training in this work, he has evolved empirically to meet a contemporary need.

The State has also recognized the need to advise boys and to help to steer them into suitable employment, and set up the Youth Employment Service in 1948 for these purposes. Youth Employment Officers now cover most areas of the country; many of them have been teachers or had experience in industry, and have become experts in local training or apprenticeship schemes and in discovering opportunities for employment in their areas. It is estimated that between 1953 and 1956 about 40 per cent. of all school leavers (boys and girls) obtained their first job with the help of this service. Its central executive has produced 80 booklets *On the Choice of Careers*, and another 40 under the title *Careers for Men and Women*. Many schools now supply reports of pupils to the Youth Employment Service. One of its aims is to steer youngsters clear of blind-alley jobs, and there is a regular follow-up of boys and girls after they have started work.

The Public Schools Appointments Bureau is another national service which has extended rapidly in the past decade; its membership of schools has more than doubled since 1948. Its representatives, who are in constant touch with employers, visit each member school annually and give careful advice to careers masters and to those boys who seek it. The bureau also believes in the importance of a first-hand insight into specific careers, and helps to organize short works courses in the Easter and summer holidays. The number of boys attending such courses has more than doubled since 1948, and is now close on 1000 each year; and as there are many applicants for whom places cannot be found, early application is advisable.

From the age of 15 it is possible to leave school, and for many boys the problem of whether to do so presents itself repeatedly, till finally there comes to some boys the further problem of whether to go to a technical college or a university. Dazzled by the short-term view of a job which seems well paid, and moved by the most commendable motives to stand on his own feet, a boy is often loath to continue the discipline of full-time learning that seems far removed from day-to-day affairs. There are employers who advise an early start to a career and advocate working up from the bottom as the best way to learn the business. Finally, parents, especially if they have already spent large sums on education, may be tempted to fall in with this advice against their better judgment. How should each individual problem be solved?

In general, a boy should continue full-time education for as long as he is capable of benefiting from it, and his schoolmaster's advice on this is invaluable. It is alleged that some children who qualify for university entrance but fail to obtain places at Oxford or Cambridge abandon the idea of further education rather than contemplate other universities. This is surely a mistake based on outworn ideas, from which both the individual and the nation must suffer; what is most important is that attendance at a university should include full integration with its life and residence among its members.

At the university a boy will be wise to postpone at least detailed decisions about his career until his final year, and to surrender himself to the studies, interests and even distractions of university life. The question of vacation work and vacation courses is a vexed one. As windows on a future career they can often be admirable, and they may have both social and economic advantages. On the other hand, vacation reading and the relaxation of full and interesting holidays are essential parts of a university education. No vacation courses should be so intensive and lengthy as to interfere with them unduly.

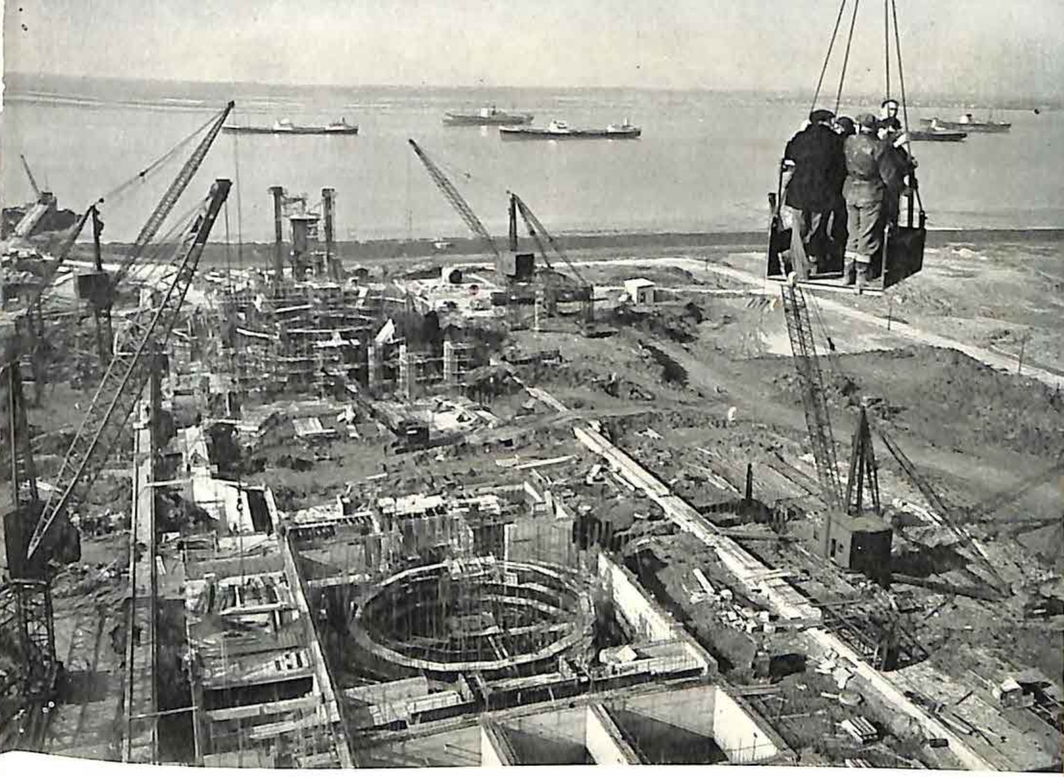
At most universities the Appointments Board is now the recognized channel through which graduates seek employment and it is estimated by some university appointments officers that about 90 per cent. of undergraduates in their universities are registered applicants. As in the schools, the best appointments officers not only supply a steady stream of edited information on every variety of career, but also obtain from university teaching staff personal information about their applicants which helps them to advise on the career to be adopted. These boards can also provide a shield against the over-zealous attentions of enthusiastic talent scouts by planning interviews with employers.

All these services, however, whether supplied by school, university or State, can only help towards the choice of a job of work. The final decision must rest with the two parties to any contract of employment. Just as employers generally are taking more trouble to choose people by means of tests, interviews and inquiries, so candidates for employment are looking more critically at what is on offer. In narrowing down the choice, the first essential is that the job should be one likely to absorb the applicant's interest; the technically qualified man does not find this so difficult as the non-technical, for whom more probing of himself and of the job is required.

Having selected the type of career, one may study the recruitment literature of many employers, but finally it is well to restrict the short list to about four or five. These will repay more intensive study by visits if possible, and by inquiries from friends or acquaintances who have become employees of these firms. Any offer of an interview should be seized because it will provide an opportunity to gain more information, which will help in making a choice.

In opening his Industrial Conference at Oxford in 1956, the Duke of Edinburgh said that after visiting many different places of work he came to realize that the most noticeable difference between them was " atmosphere ". " Some were happy places to visit and others were depressing." It is this atmosphere which, in my opinion, is more important than any other single factor. Working with congenial colleagues and being encouraged to fit oneself for promotion are other factors which should count more than a high starting salary.

If a wrong choice is made there should be no hesitation in changing before it is too late; no employer is worried about someone who has changed his job in his early years provided it is for a good reason.



1. Work in progress on the site of Bradwell Nuclear Power Station, with the river Blackwater in the background

2. After his four months' probationary period, a boy at British Railways' Crewe works discusses his future

(H 285)

3. Analytical distillation in the laboratory at Stanlow Refinery

4. Operating the pressure-dipping device which indicates the level of butane in a Shell Motor Storage sphere

3

ATTRACTIONS OF ATOMIC ENERGY

BY

Sir Donald Perrott

MEMBER FOR FINANCE AND ADMINISTRATION,
U.K. ATOMIC ENERGY AUTHORITY

With less than five years of independent existence the United Kingdom Atomic Energy Authority already has a series of notable achievements to record. Foremost among these are the first station to generate electricity on a commerical scale by nuclear means, the outstanding developments in the field of advanced nuclear reactors, and our study of controlled thermonuclear reactions—the new energy source that may come near to simulating the interior of the sun. The power station at Calder Hall (opened by the Queen on October 17, 1956), the 135-foot sphere housing the fast breeder reactor at Dounreay on the north coast of Caithness, Zeta at Harwell—each is by itself enough evidence that this country more than holds its own in technological progress and scientific ability.

The credit for these achievements belongs to the men and women who make them possible: primarily the 30,000 employees of the Authority. They are of many types, from the scientists and engineers of international reputation who guide the main advance to the skilled craftsmen and workers in the factories, laboratories, and offices. My purpose is to show broadly how some of these different people fit into the organization and how there is a career for anyone who puts interest, skill, and a sense of enthusiasm high in the list of things he asks for in his work.

The Authority's three major centres of activity are the Atomic Energy Research Establishment at Harwell, the Weapons Research Establishment at Aldermaston (both in Berkshire), and the Industrial Group, with its headquarters at Risley in Lancashire, which controls the factories and the pioneer stations in the north of England and in Scotland. But it would be a mistake to think that the main openings for scientists are solely at the research establishments in the south, and equally wrong to think that the field for engineers is entirely in the Industrial Group.

Many scientists at Harwell are engaged on basic and longer term studies leading on to applications which are studied more widely throughout the Authority. Much of the work is carried out in cooperation with the universities. Harwell itself is organized on university lines and many of the people there value an atmosphere which they find immensely stimulating to research. Much of the work of the Weapons Research Establishment also has a fundamental content, and a general application which belies its title. At Risley and in the other establishments of the Industrial Group the scientific work generally has more immediate applications to production and operational developments, but the problems there are nonetheless of intense theoretical interest.

Entry and further training

We recruit good honours graduates to a career which takes the best of them up to £2,000 a year in their thirties, after which they can proceed on merit (regardless of age) to higher appointments, with the opportunity of reaching the top scientific posts in the Authority. The next level of recruitment caters for the pass degree man or the sixth form school leaver, preferably who has gained or will gain a Higher National Certificate. His career can go up to £1,600 or more, and both he and the ordinary school leaver who comes in as a scientific assistant have opportunities of further training in the Authority which can include, in cases of sufficient merit, being sent full time to a university.

The scientific work of the Authority covers a wide field. We need physicists to provide the basic facts and the new discoveries from which power systems and plants are developed; chemists to study the chemical aspects of nuclear changes and of the special substances encountered in our new techniques (the man-made isotopes and their compounds themselves constitute a complete new industry); metallurgists to investigate the operation of new materials in reactors; and mathematicians for a range of problems including the whole new science of criticality.

Engineering in the Authority is equally wide in its scope and importance and the prospects for engineers compare with those for scientists. Because of the size and intricacy of our projects the problems of construction alone constitute a challenge to the best engineering talent. It would be hard to list the varied and novel problems, from heat exchange to control systems, which confront our designers and those who have to execute the work, while for the man who can develop a talent for management the organization of engineering work in the larger stations is itself a call to the imagination. The Authority can offer exceptional scope to engineers in all the main fields—civil, structural, mechanical, electrical and electronic—with a special field of interest for the chemical engineer. As with the scientists, senior posts run up to more than £2,000 a year, and there are much higher prizes than this for those who can show themselves capable of controlling major projects of design, operation or construction.

Professionally qualified engineers can be recruited directly. Others may come in through the drawing offices or through the Authority's apprenticeship schemes. These are described in an illustrated booklet (obtainable from Chief Labour Officer, United Kingdom Atomic Energy Authority, 11, Charles II Street, London, S.W.1) which sets out the various types of training that can be undertaken and gives details about pay, accommodation and prospects.

Like the scientists, engineers have opportunities for assistance with training ranging from help with evening classes to full-time university courses on full pay. The Authority is particularly keen to give opportunities to the man who can benefit to the extent of reaching graduate or professional level, and selected staff are enabled to take sandwich courses leading to professional qualifications or the new Diploma in Technology. These courses entail alternate half years working in the Authority and studying full time and on full pay at a university or college of advanced technology.

In all these training schemes special attention is given to the progress and welfare of younger staff. The Authority's interest in training staff is commensurate with the care taken about conditions of service generally, including welfare and social amenities and the conditions in which work is carried out. There are housing schemes and hostel accommodation at each of the Authority's establishments, and our laboratories and workshops rate among the finest and best equipped in the country. Above all, people enjoy working in the Authority, and their sense of new achievement grows as our numbers increase. We are probably the only organization of our size whose staff has doubled in the past four years.

4

THE WORLD'S NEED FOR OIL

BY
W. W. Evans
TRAINING MANAGER, BRITISH PETROLEUM CO. LTD.

An accountant, two schoolteachers, a dentist, a deep-sea trawlerman, and two storekeepers. It looks like one of those questions in an intelligence test: " find the odd-man out ", but it is not. It is a possible collection of candidates for employment in a large oil company; and the significant thing is that they could all be candidates for employment in their own profession.

The oil industry is fundamentally linked with the business of selling power, and progress in the world depends on power; controlled power applied where it is needed. Not even atomic energy is likely to oust petroleum from a key position in the supply of power in the foreseeable future. Coal supplies the bulk of it, but is not likely to increase its contribution significantly; atomic energy will find it difficult to cope even with the margin of increase in power requirements; petroleum is the major source from which the rapid increases in demands over the next few years must be met.

But before oil becomes power it has first to be found, and transported, and refined, and taken to the user. An " integrated " oil company (and most of the major companies in the business are integrated) does all of this, from exploring for new sources of oil to pumping it into the tank of the consumer, and so must necessarily be a world-wide organization of great size and complexity with an impressively varied list of employees. In fact, the employees almost represent a cross-section of the community, and the accountant, the schoolteacher, etc., can all find their places among them.

"Careers in oil" brings to mind thoughts of the geologist or geophysicist, the refinery engineer, or the chemist; the accountant, the salesman, and the administrator are all as necessary.

The activities of an oil company fall roughly into the seven following categories:

1. Exploration and Oil Production

This side of the business has gone a long way forward from the hit and miss methods of the early part of the century. The search for, and the production of, oil are now a highly scientific exercise depending on team work between the geologists, geophysicists, surveyors, chemists and engineers engaged in it. A £250,000 investment in drilling a hole 15,000 ft. to 20,000 ft. into the earth's crust, involving the use of complicated engineering and physical techniques, calls for professional ability of the highest order. For a man with an interest in the pioneering aspects of life (although now it is usually in the most comfortable conditions), who has qualified as an engineer, physicist or geologist, there is an interesting life with great prospects for responsibility and reward in oil production.

2. Refining

In the refinery, automation is not a thing of the future—it has been a reality for some years. Thus the refining and preparation of petroleum is the most highly capitalized industry in the world. A refinery employing 2,000 people could cost upwards of £50m. to erect and commission, and the vast investment of brains and energy that goes into it means that, though few in number, the men who run it must be qualitatively big. Engineers interested in immense projects of planned maintenance, or in automatic control, or who are interested in the general problems of the economics of running a large plant on a basis of continuous operation, can certainly find within the refining world a post that will meet their need. Physicists, again on the automatic control side, and in other fields, will find satisfactory opportunities. For chemists, interested in the myriad aspects of dealing with hydrocarbon oil, there are opportunities in the laboratory or on the process side of the industry.

Plastics and petro-chemicals are a new but rapidly growing development of this work, which will provide new products, new processes and therefore new careers to those who are capable of accepting the challenge.

3. Transportation

Oil is undoubtedly the most valuable single cargo transported across the seas of the world today. The great modern tankers, of up to 60,000 or even 80,000 tons, need engineers and navigating officers who are prepared to apply their professional knowledge to this specialized branch of our Merchant Marine. Navigating and engineering apprenticeships are available by which schoolboys of adequate physical and mental ability can reach positions of command and responsibility, either as masters or chief engineers, in some of the largest ships afloat.

4. Marketing

The selling of products against keen competition in established markets and the development of new markets call for a wide variety of types of men. Technologists, chemists and engineers who are prepared to apply their minds to the specialist problems of dealing with consumer requirements, as well as the less specialized arts graduates, can all find openings on this side of the petroleum business. Aviation, bunkering, lubricating oil marketing and other semi-specialist selling activities offer interesting careers with one foot in the technological and one in the commercial camp.

5. Research

It is obvious that this vast industry could only be built on a firm foundation of research, and this means the employment of engineers, physicists, chemists, mathematicians and others, dealing with both fundamental and applied research into all aspects of the search for, production, preparation and use of petroleum and its derivative products. This could range from fundamental study of, say, compounds of very high molecular weight, to the very practical study of the numerous problems arising in the use of petroleum products, burner and furnace problems, engine problems or new applications in other industries. Some of the men and women engaged here come into research work from other branches of the industry, after a period in the field or in a refinery; others come straight from the university and go out into the field later, though not necessarily so. Candidates who have a good scientific background, a bent and liking for research, will almost certainly find some creative work that is of interest to them.

6. Administration

Administration is a wide term—accountants, lawyers, purchasing officers, staff officers, and many other administrators work within a large organization. It is impossible to list all the variety of openings in this field, but specialist lawyers and accountants, as well as the more general arts and economic graduates, are needed, to begin acquiring that experience that may eventually lead them to the top of this, one of the world's greatest business activities.

7. Training

But entry is not confined to the graduate and the professional man. All the major oil companies have comprehensive training schemes designed to provide entry into the industry for boys and young men of all educational levels. The companies are all willing to provide advice whenever it is required. Any man who feels that he has anything to offer should write and ask for information.

5

THE EXCITING BUSINESS OF CHEMICALS

BY

Sir Miles Thomas

CHAIRMAN OF THE BRITISH PRODUCTIVITY COUNCIL

To young men and women of ability, the chemical industry offers interesting work in an expanding and exciting business, a wide variety of scope and opportunity, good pay—and the satisfaction of pride in achievement. Almost everywhere in the world today we find evidence of its work. Its products are in daily use and are vital to the manufacture of almost everything one can think of, including the ink you are now looking at and the paper on which it is printed.

These products number thousands and they are increasing by the score every year. Practically every other industry depends on them; sometimes great enterprises have grown solely from the discovery of a new chemical reaction. They help to increase our standard of living and to reduce pain and disease, famine and desolation. The people whom the industry attracts, therefore, may be idealists in the fullest sense of that word but their approach to the achievement of their ideals must be practical and realistic. To work for it is a challenge which may lead to high reward.

The British chemical industry represents a capital investment of several hundred million pounds. Much of this has been spent since the end of the last war on new plant and equipment, and in modernization of the old. Many millions more are expected to be invested during the next few years. It is modern and highly efficient, and the scope and diversity of its operations are probably unrivalled. Individual firms vary in size from concerns employing thousands to much smaller businesses, which play no less important a part in the nation's economy. All of them offer scope for people with ambition, imagination, integrity and—and this is not putting it too high—a sense of service.

Entry from Technical College or University

By its very nature, the industry offers its greatest promise to those who form its backbone, the chemists, chemical engineers, physicists and engineers with sound technical qualifications. But there is scope too for other scientists, for arts graduates, and for those with manual skill, commercial sense or general ability. Success, I have always maintained, stems from the individual, not from the job.

For scientists and engineers the foundations must be laid in their pre-university education. At school they should read chemistry, physics and mathematics to advanced or scholarship level, and take a strong interest in the additional subjects needed to meet the entry requirements of university or technical college. In his last two or three years at school the prospective science undergraduate may be tempted or encouraged to specialize, and may tend to neglect those other subjects which examiners seem perversely to demand but which appear to have little bearing on acquiring a knowledge of science. But he should not get the idea that these non-science subjects are unimportant and that anything will do so long as he can scrape by the examiners in them. Specialization is needed in this complex world, but it must not be so intense as to leave no room for other aspects of knowledge. In particular, he must not neglect the study of English. The importance of being able to express oneself clearly and concisely, to state a case simply and logically, cannot be overemphasized. Ability to do so may make all the difference between an average job and one at the top of the profession.

Assuming that a man or woman has a solid education at school to back progress through university or technical college, the most useful asset for gaining entry into the chemicals industry is a degree in chemistry, physics and chemical engineering, though the other natural sciences and branches of engineering are increasingly finding their place. To the graduate there opens a variety of rewarding jobs, depending on talent and inclination. If he has an inquiring mind and is prepared to spend some six years on advanced education to obtain a Ph.D. degree, he may be attracted to the field of research and development. There is ever-increasing interest and regard paid to the great amount of research, pure and applied being undertaken. He would be engaged either in the investigation or development of new products and processes or in the application of chemistry to industrial uses. If his qualifications are in pure chemistry he may prefer the analytical laboratory, where his work would be concerned with ensuring the quality of the company's products and raw materials.

Alternatively, if he enjoys day-to-day contact with a wide variety of people he may find an opening in the sales or purchasing side. Technical service is of growing importance in the relationship between the chemicals industry and its customers, and the demand for salesmen with technical knowledge is increasing yearly. The sales side is very important and held in very high respect, and its rewards can often outstrip those in other fields.

All these " non-laboratory " aspects call for many qualities in addition to good technical training. Perhaps the most demanding is production, which will have particular attractions for the ambitious and versatile man. Here he would have direct responsibility for the manufacture of chemical products. For work in this sphere the chemist who has post-graduate training in chemical engineering is likely to be the best man, but openings also exist for those with degrees in applied chemistry or chemical engineering alone.

Equally important as sound technical training for the production man is his personality and ability to get on with all types of people. He will combine his technical experience with general commercial knowledge and a talent for organization and administration: he will move on towards a post on the management side, where the need for such a combination of abilities is increasingly great.

Alongside the chemist and chemical engineer, there is a big demand for mechanical and electrical engineers. The great programmes of expansion being carried out in many quarters of the industry offer a fascinating challenge, and the high and continually increasing degree of instrumentation and automation calls for men with special knowledge of instruments and electronics. This expansion also demands the best mechanical engineers who are engaged chiefly on the design and construction of new plant.

For the arts graduate with a good degree and for the economist there is room on the sales side or in market research and other sections in which a science background is not needed, but naturally such jobs are more limited in number.

What are the prospects? Initially the graduate entering the chemical industry will probably get about £700 a year, while a man or woman with a Ph.D. may receive £150 more. By the time he is 30 to 32, he should be earning £1,200 a year, while in the higher ranges a works manager—usually recruited from the production side—in charge of a factory of about 1,000 employees will receive over £2,000.

And now, what about the young man or woman who has not gone to university or technical college, but who has had to end the years of formal education earlier? The doors of the chemical industry are not closed to them.

Opportunities for school leavers—further education

The boy or girl leaving school with a General Certificate of Education can find work with a large number of firms as a laboratory assistant and will be encouraged to study for a degree or comparable qualification. Often, time is allowed off for attendance at a technical college. This path to achievement demands hard work and persistence, but the results can lead eventually to positions of importance and responsibility.

As an alternative to part-time work and study some firms offer university scholarships to young employees of promise who have shown their ability in part-time study. Yet a third way to obtaining higher qualifications is provided by the sandwich courses based on alternate periods at work in the industry and at university or technical colleges. There are also apprentice training courses for youths who aim to become engineers, and special craft courses for those unlikely to benefit from learning the theoretical aspect of engineering. A comparatively recent development is the scheme providing qualified chemical process operators. It is parallel with apprenticeship in one of the crafts and it gives a carefully prepared course in the factory and the technical college through part-time release. A boy successful in this course may eventually become a foreman or supervisor.

Throughout I have referred to men and women. At present, however, the opportunities for women are confined mainly to research and analytical work. But the day is fast approaching when they will be given wider responsibilities in the factories.

In this article I have been able to do no more than outline briefly the main avenues of entry into this great and growing business of chemical manufacture. Those who wish to know more and fuller details should consult any firm in the industry, the University Appointments Board, school careers master, youth employment officer or similar official. Any of them will be glad to give more information on how to take the first steps to become a member of an industry which is one of the keystones of our national economy and on whose future depends to a large extent the future of the country.

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6

ENGINEERS AND MANAGERS FOR THE COAL MINES

BY

J. O. Blair-Cunynghame

MEMBER OF STAFF, NATIONAL COAL BOARD

Since Britain became an industrial nation, coal has been the basis of her economy. It is likely, over the long term, that there will be gradual industrial expansion demanding more and more power. Even with the timely help of nuclear energy, and the developments that are being made in the use of oil fuels, the increase in production that is within our capacity will not be possible without greater supplies of coal.

An appreciation of the importance of coal to the future of the country has opened the doors to the expansion and reconstruction of the coal mining industry. In the 10 years ending in 1965 it is intended to invest £1,000m. in reconstruction and modernization, in opening more than 20 new collieries, and in 250 other major schemes of reconstruction.

This programme will call for the application of the highest managerial, engineering and scientific knowledge and skill. The coal industry wants engineers who will also be managers. By law, the colliery manager must be a mining engineer; and the most senior executive posts, right to the top of the tree, are open to him. There are more than 800 collieries. The management organization above the colliery is first the Group (four collieries, as an average) in charge of a Group Manager (who is always a mining engineer), and then the Area (48 in all) for which the Area General Manager is responsible, with various engineering, scientific and non-technical departments to assist him. Above the Areas are the Divisional Boards, of which one member at least is always a mining engineer, and the National Board.

Mining Engineers

There are two roads to becoming a mining engineer. For the boy who wants to go to a university straight from school, there are nine universities offering courses leading to honours degrees in mining engineering, for which a State scholarship or L.E.A. award can, of course, be used. But, in addition, the Board offers up to 100 scholarships each year to the same value as State scholarships but without any means test based on the parents' income. Applications are invited during the first term of the school year and awards are made on the basis of the results of the G.C.E. examinations at " O " and " A " level, together with headmasters' reports, and interviews in Divisions or at Headquarters.

After taking his degree, a graduate is eligible to enter a training scheme lasting three years which will give him the practical experience necessary for a colliery manager's certificate and the first grounding in training for management. The salaries paid during this period compare well with those offered to graduate trainees in industry generally. With his training behind him, a young man will go on into junior supervisory or staff posts and should be ready to assume a colliery manager's responsibility in his early thirties.

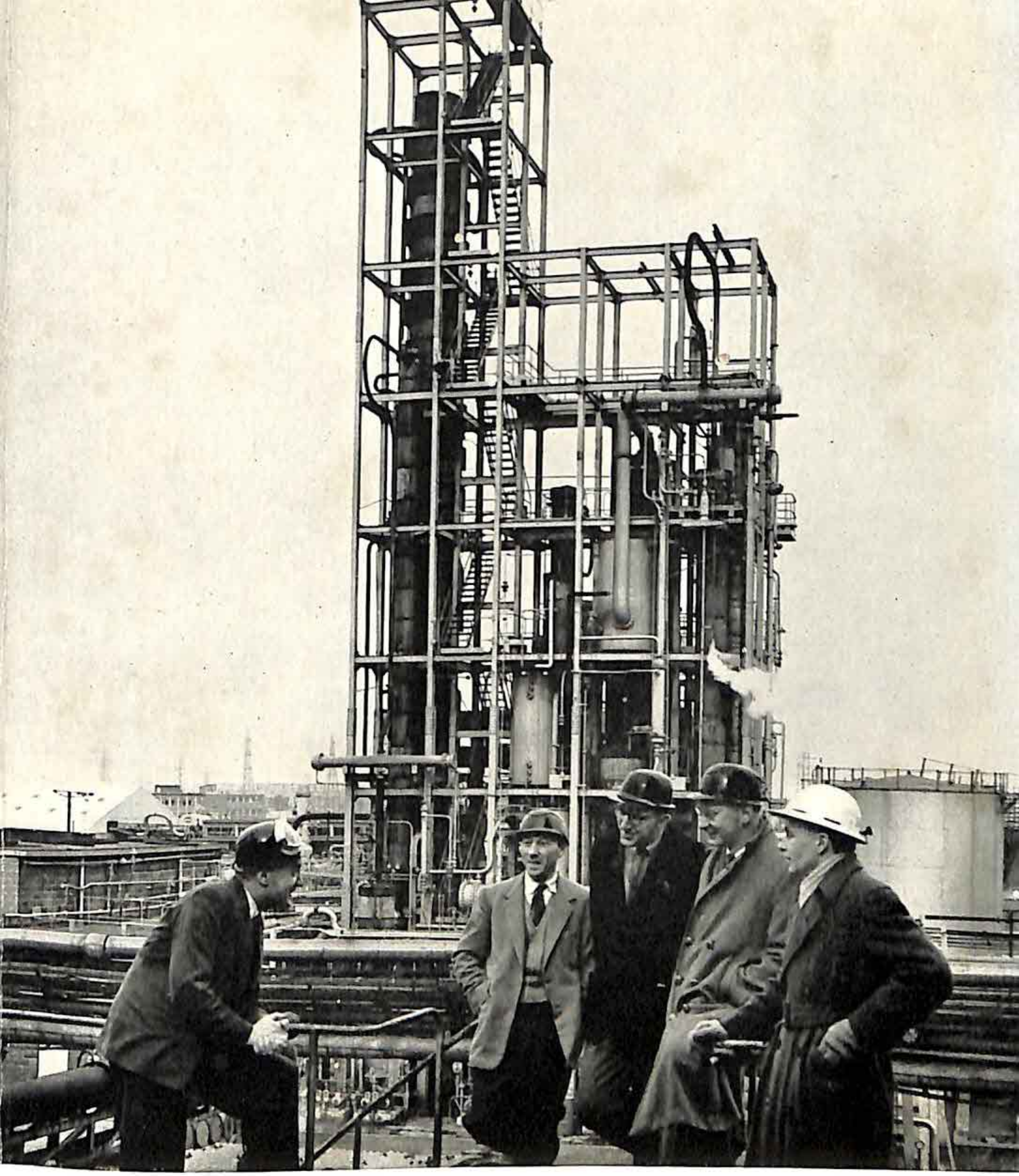
For those who want to get down to a job when they leave school, there is the Student Apprenticeship Scheme in mining, normally lasting five years, open to boys with good G.C.E. results at " O " level; those who have taken science subjects at " A " level can hope to make faster progress. There is a long tradition in the coal industry of advancement through part-time education, which the Board has been proud to carry on and develop very extensively. Boys are given day-release for National certificates and other courses, followed by a year's full-time study for a National diploma, or may be entered on sandwich courses (six months' study at a technical college on full pay alternating with six months on the job), leading to the same qualification. Young men who reach this stage are eligible for the scheme of management training mentioned above, but with their background in the industry would normally need only half the period spent by graduates. From the National diploma to the colliery manager's certificate is but a short step. It should also be noted that those who come into the industry as boys are not necessarily forgoing the chance of going to a university; the Board's scholarships described above are open equally to boys already in the industry.

Normally colliery operations and the development of new pits make big demands on other branches of engineering—electrical, mechanical, civil and chemical. The scholarship scheme includes awards in these branches of engineering, while schemes of student apprenticeship in mechanical and electrical engineering are open to boys coming into the industry straight from school. The schemes of education and training are very similar to those already described and offer corresponding opportunities.

Research and Sales

The Board's scientific work is carried out in two research establishments and in laboratories in all the Areas. One of the research establishments is concerned with physical and engineering problems involved and in the mining of coal, while the other is mainly concerned with research into the production of smokeless fuels. The laboratories in the coalfields provide a service of testing and control as an aid to management, combined with some research into their own techniques. All this work calls for graduates with good honours degrees in chemistry, physics, chemical engineering, metallurgy, and mathematics, who are recruited direct into the laboratories. Boys from school with G.C.E. at " O " level or " A " level can enter as technical officers and are encouraged by day-release, with pay, to study for National certificates and higher qualifications which will enable them to fill posts alongside graduates. University scholarships are available for the most promising young people.

The non-technical side of the industry is also of the first importance. Marketing, industrial relations, purchasing and stores, finance, the secretary's and staff departments can offer interesting and attractive careers to boys and girls leaving school, who can acquire qualifications useful to them in their careers by taking advantage of the Board's schemes for part-time study; a few university scholarships are also offered to those already in the Board's service. Arts graduates can join the Administrative



5. Graduate staff with a senior technologist at the Petrochemicals works near Manchester. The plant in the background converts propylene into isopropyl alcohol by reaction with sulphuric acid, followed by hydrolysis and distillation. This alcohol is widely used in industry as a solvent and in the manufacture of paints, resins and pharmaceuticals, or for further conversion into acetone

6. Growing pure cultures of micro-organisms for effluent disposal at the Gas Council's Fulham Research Centre

7. Trainees being shown how to set a 'Schwarz' prop at Wigan Junction Colliery

Assistants Scheme which provides two years' training over a wide field in the non-technical departments.

The Policy for Promotion

It may well be asked what in fact determines the pattern of a person's career and the jobs he takes up. I should emphasize that the individual, if he makes the best use of his chances to acquire the necessary qualifications, has a large say in his own future. Vacancies that arise in any post through promotion or retirement, etc., are systematically made known to the staff and anyone may apply to be considered; selection is made by a panel. It is the Board's policy to fill posts as far as practicable by promotion from within the industry. In addition, of course, management at all levels, assisted by the staff department, try to ensure that talent is recognized, and that young people have the opportunity to make the best use of their capabilities and are properly advised in the Board's interests as well as their own.

To those who wish to learn more about the opportunities we have to offer we shall be glad to send brochures and other particulars on application to the Staff Department, Hobart House, London, S.W.1, or to any of the Divisional Headquarters in Edinburgh, Newcastle, Sheffield, Manchester, Nottingham, Dudley, Cardiff, and Dover.

5

7

WIDENING HORIZONS IN GAS

BY

Sir Harold Smith

CHAIRMAN OF THE GAS COUNCIL

Never has the gas industry been more virile and forward-looking than it is today. The compass of its activities has grown far wider, its need for highly skilled specialists far greater, and any young engineer, scientist, or chemist can look to it to provide a rewarding career. This Spring a revolutionary tanker now under construction in an American shipyard will bring the first experimental shipment of liquefied natural gas ever transported to Britain. This is one example of this adventuring spirit that intends to fulfil the increasing demand for a refined fuel at an economic price.

Traditionally, the gas industry has been built on the carbonization of coal. Today, however, good quality carbonizing coal is not so readily available and is growing progressively more expensive. The industry, therefore, is turning to other raw materials—oil, " tail " gases from oil refineries, and lower rank small coal hitherto unsuited for gas-making. It is also searching for natural gas beneath our own soil and looking forward to the prospect of importing natural gas from parts of America and the Middle East.

In its 150 years' history its function has changed from the supplier of light to that of heat. Industrially the use of gas has increased 60 per cent. in the past 10 years. Practically every manufactured commodity in everyday use needs heat treatment at some time during processing. In no fewer than 4,000 different industrial processes gas is used. Along with this transition has grown the importance of by-products. For this is also a chemical industry supplying tar, sulphur, ammonia and benzole used in manufacturing such items as drugs, dyes, insecticides, fertilizers and plastics. It follows that with these ever-widening horizons, the greater research and development involved, and the closer integration through gas grids which may eventually be linked up to become one vast national grid, the opportunities for exciting careers are better than ever before.

Although there is room in this specialist and highly technical industry for men who have qualified as accountants, lawyers, or statisticians, a technical background of engineering or chemistry—and preferably both—is of immense help to the new entrant with ambitions to rise to the top. Civil, structural and chemical engineers for designing and erecting the large buildings and structures on modern gas works; mechanical and electrical engineers for the design, installation and maintenance of plant; scientists and chemists for research, development and testing—all are needed. But most of all, there is a need for gas engineers, those having the blend of engineering with chemistry, together with a knowledge of the industry itself. Many engineers employed first specialize either in civil or mechanical engineering, turning later to gas engineering. Indeed, some engineers are employed purely as civil, mechanical, structural or electrical engineers.

The Ways in

There is thus as wide a diversity of technological employment as could be found in any one industry. There are three recognized methods of entering:

1.—By taking a university degree in science, engineering, chemical engineering, or in gas engineering.

2.—By becoming, on leaving school or after passing through a university, a pupil of a Gas Board.

3.—By entering from school as a junior in the drawing office or laboratory, or some other junior position.

It may be asked whether a young man who proposes to enter through a university should specialize in the specific subject of gas engineering from the beginning, or whether he should first take a degree in pure science. The best advice is probably to take a science degree and then to specialize—a valuable way of doing this is to spend another year or two at an appropriate university to take a course in gas or chemical engineering.

The division between apprentices and university graduates is by no means watertight. A gas-fitting apprentice who shows ability is encouraged to study for a professional qualification and can progress to the highest positions. Further education is encouraged. Sandwich courses for engineers are supported by the Area Gas Boards and are available at certain technical colleges. There are also arrangements with technical colleges whereby employees can study at night and in most cases attend day courses. Often fees are refunded and travelling allowances paid, and release with full pay is granted to day students.

Women in the Industry

So far the emphasis has been on a career for men. At first sight the gas industry may not appear to offer a very attractive career for women. The work of manufacturing and distributing gas is essentially a man's job. When it comes to selling gas, however, there is wide scope. More than half of all the gas produced is used in the home: the 11,500,000 domestic consumers are the industry's best customers. Who better to " sell " gas to British housewives than women trained in all branches of housewifery who can give reliable advice on household problems, as well as show customers how to get the best service from gas at the lowest cost?

Area Gas Boards employ a corps of women called Home Service Advisers. Generally speaking, the minimum qualification required is at least two years' full-time training in domestic subjects. For girls with a scientific bent there are increasing openings in laboratories. Qualified women chemists are employed on the pure research side. One woman bacteriologist, for instance, is now trying to develop a strain of bacteria capable of destroying the toxic substances in gas works' effluent.

Employees enjoy not only reasonable security but the consciousness of doing a useful job of work for the country as a whole. Nationalization has done nothing to take away the ladder to success. In fact, the training needed by those wishing to qualify for promotion is more readily available than ever before.

8

CAREERS IN ELECTRICITY SUPPLY

BY

Sir Henry Self

CHAIRMAN OF THE ELECTRICITY COUNCIL

Few men are born with a natural instinct that guides them to their right career—and these fortunate few have little need of a guide. They seek only an opportunity to develop their special interests; if asked later in life whether they would make the same choice if they had the opportunity to start again, they will return a confident "Yes". For most young people, however, the choice is more difficult. It needs to be stimulated by parents or teachers and aided by all the media of modern publicity: advertisements, exhibitions, films—and articles such as this.

For both these types—the specialist and the less dedicated and more versatile individual—the electricity supply industry has a place. Employing as it does 185,000 men and women throughout England and Wales, it offers careers of the most varied character. Yet they have one thing in common: opportunity. For this there are three main reasons. First, the rising need of the nation for power, which means considerable development both in normal engineering and in the field of nuclear energy. Secondly, the facilities for further education and training which enable everyone to develop his potentialities to their fullest extent; thirdly, the fact that advancement depends solely on merit.

This means in practice that we do not offer guarantees to the new recruit—other than the guarantee that he will have every assistance in developing his own particular professional skill to the fullest extent. In our view promotion should be by means of competition, and accordingly we do not give any undertaking that any recruit, whether he be from public or grammar school, from university or technical college, will earn a specific salary, or exercise a specific amount of responsibility, by a certain age. What we do promise is that the openings will be there if he cares to seize them.

Student apprentices and graduate trainees

This is, above all, a technical industry and it must therefore have engineers, technologists and technicians. For the engineer we provide two main routes of entry: by student apprenticeship and by graduate traineeship.

In potential student apprentices today we are looking increasingly for the science-minded sixth former with a G.C.E. at " A " level in mathematics and physics. Such a young man will be trained, wherever a suitable college is available, by means of a sandwich course. He will, we hope, take away from his time at college much more than merely a basis of professional knowledge, important though that is. Our young engineer, we believe, should learn on his sandwich course some of those social skills, and the self-confidence that goes with them, that are so important in an industry where many of our staff are in daily contact with the public.

On completion of his training, our student apprentice will, we trust, obtain his Higher National Diploma in Mechanical or Electrical Engineering, and he will then start work as a General Assistant Engineer in the field he has selected. For Higher National Diploma, of course, one can also read Diploma of Technology. We have maintained close liaison with the new colleges of advanced technology and expect to be among the first industries in the country to employ those with this qualification. The combination of practical knowledge with academic theory which the Diploma of Technology offers is exactly in line with what we have always sought to achieve in the training of our engineers—broadness of outlook, combined with a solid groundwork of theory.

It is still possible to become a student apprentice without the two " A " level subjects. From boys leaving school at 16 we look for four " O " level passes, one in English and one in mathematics, a science and at least one other subject. Training in these cases will cover five years and will usually lead to the Higher National Certificate in Engineering by means of attendance at a technical college on a day-release basis.

Similar qualifications to those demanded from the student apprentice are sought in our draughtsmen and chemist trainees—though in the latter case chemistry takes the place of physics as the science subject required. Instruction in these two cases also is by a combination of practical training and day-release.

Not all our student apprentices will reach their goal of professional status via day-release or sandwich course. Some exceptionally promising apprentices will be selected to attend a university full time to read for a degree. Our training policy is flexible and its dominant principle is that everyone should receive the training appropriate to his particular aptitude—which may range from on-the-job training to a university course.

Student apprenticeship is the first, and broadest, road by which we ensure that our future requirements for engineers will be met. A second, narrower, path is by the graduate training scheme, to qualify for admission to which a young man must have a degree in engineering from a British university or equivalent qualification.

The graduate trainee spends his two years under training gaining practical experience, not merely in the section of the industry—generation, transmission or distribution—that he desires to make particularly his own, but on the other sides as well. Some time will be spent with a manufacturer of heavy electrical or associated equipment. Our aim here is to help a man to determine where his main interest lies and to avoid any narrowness of outlook.

Appointment following completion of training is usually in the first place into the grade of General Assistant Engineer probably with a salary of upwards of £700 a year. Prospects thereafter are bright. Let me quote some examples; in one Board, for instance, a young man who joined as a graduate trainee in 1946 is now a specialist adviser on the applications of electricity to mining operations at a salary close to £1,700 a year. On the generation side a man who finished training less than six years ago is now earning over £1,300 a year as an engineer in a power station. When our Universities' Recruitment Panel visited one university recently the Chief Engineer of the Area Board who sat on the

Recruitment Panel was himself an " old boy " of one of the industry's earlier graduate training schemes.

Technical competence and the capacity to get on with one's fellow men are, of course, valuable in any industry, and ours is certainly no exception. But in electricity supply as in other concerns there is a difference of emphasis on the qualities needed in particular posts. Thus, the young man primarily interested in engineering plant is likely to find a career on the generating side most to his taste, while his contemporary who combines technical competence with a desire for outside contacts will probably be most at home on the distribution side. The commercial side of the Board's work often tends to be overlooked by the outsider. It is, however, so important that in some areas apprentices are earmarked early in their training for commercial work, while in other areas engineers begin to specialize in it as soon as they are trained.

Managerial training

We have given a great deal of thought to methods of further training after appointment. In our view the best preparation for the exercise of managerial responsibility is a wide and varied knowledge of the problems of all sides of the industry, preferably gained by personal experience. We begin this process of extending the mental horizons during training and we try to continue it throughout his career. A young engineer is thus encouraged to fit himself for promotion by movement from one department to another within his own Board, and the same aim is achieved, more strikingly, for some selected individuals by interchange with foreign electricity undertakings or by attendance at outside courses, such as those of the Administrative Staff College. Our main formal means of executive development training, which supplements the private efforts of the individual to keep in contact with the work of the industry outside his own particular field, is by internal management courses, at which small groups of potential managers, usually equally divided between technical and administrative staff, spend three weeks at one of our two residential training centres. With the aid of suggested reading and outside speakers, they consider a number of selected projects such as—to take some actual examples—budgetary and cost control in the industry, tariff policy, and personnel policy.

Work in the nuclear field

A word here about nuclear power. This phrase has come to hold for our generation a quality that is almost magical, and many of the most forward-looking of our young men today are interested in the possibilities of a career in this field. It is, however, not easy to give them precise advice at this early stage, for though three nuclear power stations are now in course of erection, and others are planned, the first will not be in operation before 1960. The Central Electricity Generating Board, so recently set up, is now working out its staffing policy for the operation of these stations. Some of the engineers and physicists who operate them may be specialists whose experience has been exclusively in the nuclear field. Others will probably have worked as engineers in "conventional" coal-fired stations and have transferred to the nuclear side of the industry after taking special courses of training. What is already plain is that these stations, costly to create but economical to operate, will play an increasingly important part in the development of our industry.

Opportunities on the non-technical side

What of the non-technical young man or woman who is so easily overlooked in considering careers? We employ a number of Arts graduates, required for specific posts and free thereafter to make their way in the industry, and also take in a fair proportion of "O" level and "A" level fifth and sixth formers from the grammar schools to fill clerical and administrative posts and to join our Trainee-Accountant Scheme. For them, as for all our staff under 21, there is provision for day-release to obtain further qualifications, possibly as members of the Chartered Institute of Secretaries or some similar body. The prospects on this side are fully equal to those in administrative work elsewhere.

In addition to such posts, which are open to both sexes, some types of work, such as that of demonstrator, are reserved specifically for women, and we prefer them to come to us with a good G.C.E. including English and mathematics. For the girl with an aptitude for domestic science, day-release facilities are provided where a suitable course is available leading to the Certificate of the Electrical Association for Women, or similar qualification, or, after two years in a responsible position, to the Association's

Diploma, the holder of which is a fully qualified housecraft adviser.

This, then, is the electricity supply industry—a working partnership of men and women of all types serving in all parts of the country. We believe that to almost every category of able school leaver or forward-looking university graduate we offer an adequately paid career, with good working conditions and enlightened training policies. We claim, too, to offer something more: the opportunity to play a responsible role in a vital public service.

9

BUILDING OUR LINES OF COMMUNICATION

BY

Sir Godfrey Ince

CHAIRMAN OF CABLE & WIRELESS LTD.

If a boy's ambition be to serve his fellows, to promote understanding between men and nations and to keep himself in the forefront of advancing scientific knowledge, he could not do better when selecting a career than consider the opportunities offered by telecommunications.

Here is a field of endeavour with a history dating back to the beacon chains and the heliograph of the ancient Greeks and Romans, and a future that assures it of a prominent place in the space age. In the centuries between, it has provided, as it will continue to provide one of the principal means by which men advance themselves intellectually and bring order into their affairs.

A career in telecommunications is open to almost any schoolboy with a bent for mathematics and physics. It is not closed, as are some fields of scientific work, to all but those endowed with the opportunity and special gifts required to obtain a university degree. A General Certificate of Education at ordinary level is sufficient to open the way into the large telecommunications undertakings, and, to those who enter, a path of progress lies open to the top.

Research, maintenance, and service abroad

Few careers offer such opportunities for specialization on particular lines of research and development work and the spectacular advances of line communications in recent years are an example of what the specialists may achieve. They have enabled 960 telephone conversations to be carried simultaneously over a single pair of landlines, and 36 on a pair of cables across the Atlantic. It is only two and a half years since this first transatlantic telephone cable—or pair of cables—was opened; but already research has made it possible for my company and the Canadian Overseas Telecommunication Corporation to plan to lay another in 1961 which will consist of a single cable capable of carrying 60 telephone conversations.

In addition, however, to the pure scientists and the engineers in the laboratories required to ensure that developments of this kind enable telecommunications to meet the ever-increasing demands made on them, there is need for practical men, with all-round general knowledge and mechanical handiness, to go out into the world to apply the knowledge thus acquired. Nowhere is the need for these practical men so great as in Cable and Wireless Ltd.

But we have to add one more to the list of qualifications required—namely, an enthusiasm for travel abroad, and with it a willingness to work with and get to understand men of other races. This need arises from the fact that Cable and Wireless Ltd. is concerned with oversea telecommunications, and is the largest part of the great Commonwealth system. Within the system, the company's role is to link the member nations, each of which has its own domestic services; and to provide and work the services of commonwealth territories and foreign countries in which concessions are held.

To fulfil its functions, the company has to maintain and develop the 147,000 mile, world-wide cable network which it owns; and to operate 120 wireless circuits covering an aggregate of some 200,000 miles. It works from 105 stations oversea, of which 41 are within the Commonwealth and 64 in foreign countries, and it has a fleet of eight cableships to keep the cable network in repair.

Many of the stations conduct both cable and wireless services. Some are large stations with relatively large staffs; many are small with correspondingly small staffs. A total staff of 8,700 man the stations, 8,000 of whom are recruited locally. The remaining 700, mainly recruited in the United Kingdom, form a mobile foreign service staff.

For recruits to the foreign service staff the company relies mainly on young men between the ages of 17 and 23 years. A General Certificate of Education with a minimum of five passes at Ordinary level, including English language, mathematics and physics, is an essential qualification.

There are three entries a year, and the boys selected go first to the company's engineering school at Porthcurno, near Land's End, for an 18 months course in two parts. In the first part they are taught mathematics, the theory and practical application of electricity and magnetism, the elements of telegraph operating and workshop practice in maintenance of equipment used on the oversea stations. In the second part, they learn all phases of the work they will be expected to do when first posted oversea.

From Porthcurno the students go for six months' consolidation of training to one of the larger oversea stations: thereafter they may be posted to any of the other stations for their first tour of duty abroad, which lasts four years. Subsequent tours are of three years' duration.

A limited number of students who leave Porthcurno with Advanced level passes in mathematics and physics are selected for a further course of training after their first tour abroad. All are encouraged to work during their first 12 years' service for two of the company's internal examinations, each of which entitles them to promotion. Higher promotion is by merit and seniority.

There is a system of allowances, in addition to salary, which compensates foreign service men for the widely differing living costs in the many countries in which they serve. A staff education scheme, assisted by the company, helps them to meet the cost of educating their children in England. There is also a contributory pension scheme which provides a half pay pension after 37 years' service.

These, in summary, are the requirements and the tangible rewards of service with the company. In the great enterprise of building up Commonwealth communications. I know of no more responsible calling for the right type of young man, for, day by day, whether he be stationed in one of the great cities of the world or in some remote outpost, the Commonwealth will rely on him to keep open its lines of communication.

10

THE FASCINATION OF ELECTRONICS

BY

J. G. G. Gilbert

HEAD OF DEPARTMENT OF TELECOMMUNICATIONS,
NORTHERN POLYTECHNIC, LONDON

The art and science of electrical engineering, embracing electricity generation and utilization and the manufacture of a wide range of electrical equipment, is a comparative newcomer to the industrial scene. Our accepted standard of living owes much to the rapid and continuing progress of the electrical industry. No section of that industry has advanced so rapidly in the past two decades as that branch known as Electronics.

Development of the Industry

Before 1939 the electronic industry was very limited. Now it covers such a wide range of functions in industry, medicine and science that the problem is to give a clear definition of its coverage. Probably it is best defined as the application of thermionic valves and semi-conductors to fields outside broadcasting, television and tele-communications.

It was from the fertile brains of the scientists and engineers employed in the radio industry that other uses for valve circuits were envisaged. The first applications were for measuring instruments, such as valve-operated voltmeters, signal generators, and similar tools needed for furthering radio techniques. Soon the cathode ray oscillograph became a familiar instrument in research laboratories, and in 1936 it became the familiar viewing screen in television. But up to the Second World War, the component and valve manufacturers were mostly working for the entertainment industry, a very competitive market that sold little of its output oversea.

The second war created an immediate demand for components and valves with long life that would operate under conditions very different from the domestic field, in extremes of temperature and humidity, vibration and acceleration. Equipment was made that could be operated for 24 hours every day without failure or change of performance. In 1945 the skill and ingenuity of the research and development engineers was turned from warlike to peaceful use of their techniques. Moreover industrialists were at last willing to accept electronic aids to industry, for they were assured that the equipment would operate faultlessly over long periods.

Nowadays the applications of electronics to industry and science cover analogue and digital computers, guided missiles, radar, automation, servo-mechanisms, telemetering, instrumentation, atomic energy and a host of other related subjects as well as communications. Basically, all these applications have grown out of the ordinary radio valve and the circuits familiar to the communication engineer. Even in his field, it is safe to say that without the use of electronics the aircraft industry could not have developed to its present state. Modern passenger and military aircraft are flying electronic laboratories, and already in the United States the great motor manufacturers are using electronic methods of erecting roofs automatically at the first spot of rain, or of deflecting headlight beams on meeting oncoming cars.

Qualifications and Training for entry

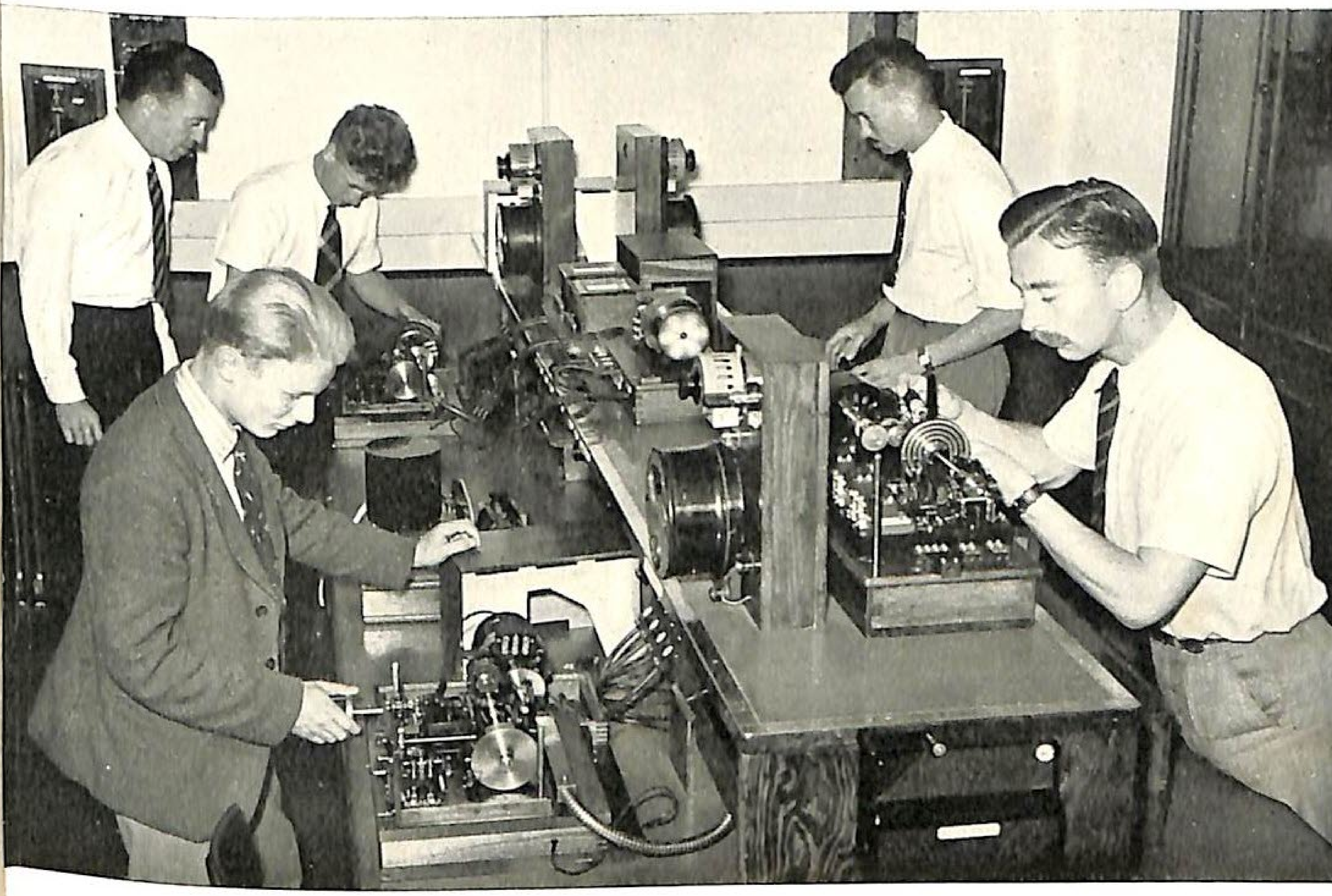
This is one of the most progressive of all industries, offering a wide scope to its present and future recruits. But a word of warning is necessary: it requires only those people who are prepared to assimilate knowledge continuously and to study for their working years. What qualifications are necessary to enter the industry? A young man or woman seeking a professional career would be well advised first to aim at passing the General Certificate of Education Advanced Level in Mathematics and Physics backed by Ordinary Level success in English and other scientific and cultural subjects, although entry into the profession is possible with these subjects at Ordinary Level. With the former qualifications he can enter a course leading either to a university degree or Diploma in Technology in Electrical Engineering, in either case specializing in Electronics in the latter stage of the course if he so desires. In addition to his academic work a prospective professional engineer obtains practical training in industry. The university man usually enters a graduate apprenticeship after the award of his degree, receiving training with the industrial organization of his choice. The boy reading for the Dip. Tech. in Engineering receives training in a different, though equivalent, way. He attends a major technical college for six months of each of four years, the remainder of his time is spent as a student apprentice under training in industry. These are the best routes for complying with the requirements for membership of The Institution of Electrical Engineers.

The apprentice is paid a sufficient wage to support himself while he is being trained, and he will not have had to do his national service until he has completed his training. At first he will go into the various branches of the organization—the drawing office, machine shop, the assembly lines, the test rooms—and be given every chance to learn about the products of the company, its methods of production, and something of industrial management.

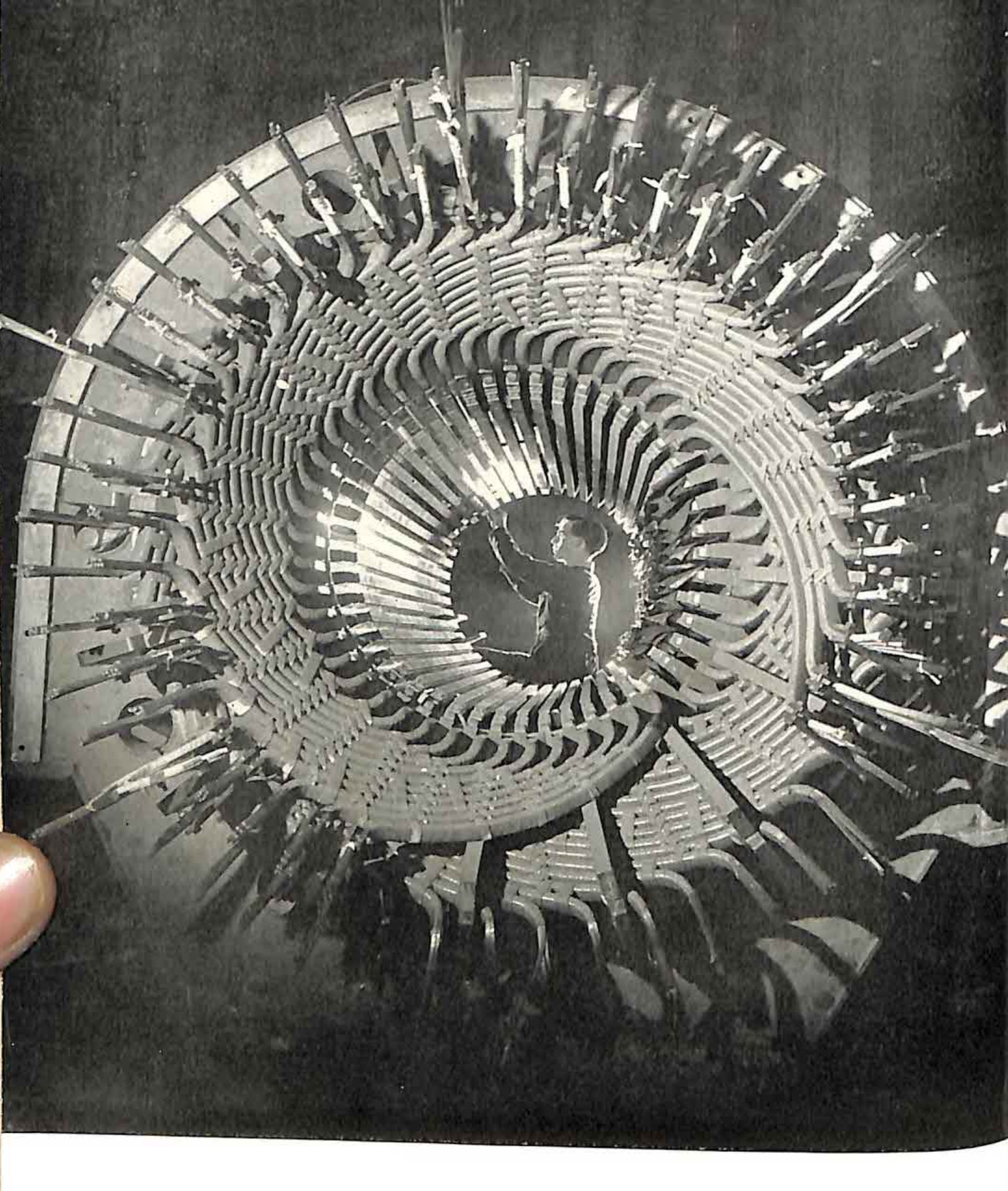
Though the methods described above are the two types of study recommended for those who seek the highest engineering positions, it is still possible to obtain considerable advancement by part-time study. A young man entering the industry with General Certificate of Education qualifications at Ordinary Level is normally allowed to spend one day per week at college. His employer often gives him a grant to cover fees for text books, for this is a sound investment. He may study for National Certificates in Electrical Engineering, Mechanical Engineering or Applied Physics or for City and Guilds Certificates. These are qualifications in their own right for men occupying important posts in the industry and when suitably augmented by other subjects may lead to membership of a professional Engineering Institution and to positions of the highest responsibility in industry.

As an alternative to entering the industry direct from grammar school, it is possible to be a full-time student at a polytechnic or technical college. Naturally the training is accelerated, for the boy spends about 30 hours a week studying and gaining practical knowledge. Typical of such courses is one held at the Northern

8. An apprentice at a Turbine Control Valve



9. Students at work in the instrument room at the Engineering School of Cable and Wireless Ltd.



10. A senior apprentice at The English Electric Company's Stafford Works helping to wind the stator of a 30 MW turbo-alternator for export

Polytechnic, where students enrol for a four-year course in Telecommunication Engineering, during which they study all the basic groundwork of electronic engineering. At the end of this period they sit for the Full Technological Certificate of the City and Guilds of London Institute, and for the Graduateship examination of the British Institution of Radio Engineers, although the course is not recognized by the Institution of Electrical Engineers. Not only will the student cover the theoretical aspects of the subject matter, but he will be trained also in technical drawing, mechanical engineering as applied to electronics, and much experimental verification of circuit design in well-equipped laboratories. He will have the opportunity of visiting a number of commercial firms and Government laboratories, and of hearing addresses from leading persons in the industry. During the summer vacation he will be invited to work in the laboratories of well-known commercial firms, thus receiving a preview of his future in industry.

Opportunities

One has only to read the hundreds of advertisements in the national and technical Press to realize the great shortage of qualified engineers, draughtsmen and designers in this ever-broadening industry. Although it must be the ambition of every young man to go into the more exciting research and development fields, there are many opportunities for those who cannot reach the necessary high educational standard. Many persons are also required for the manufacture and testing of electronic apparatus and for its installation, operation, and maintenance. There is practically no industry that does not, or could not, use electronic equipment, and it is for the young engineer to discover and develop new ideas and applications. The great developments that have taken place in the past few years show the future that lies ahead in the electronic field.

Applications of electronics

Electronic computers can now do office work such as preparing wage slips, controlling orders and stocking or regulating machine tools at a greater speed than is possible for a human operator. In the field of medicines special forms of television techniques are used for research and teaching. Recently a British company demonstrated for the first time an ultra-violet microscope producing instantaneous pictures on a screen. In the past, much valuable information, particularly in cancer research, has been gained but slowly because of the high cost of a conventional ultra-violet microscope. This device uses a cadmium flash for the ultra-violet light, but the high intensity required to record on a photographic plate unfortunately kills the specimen. It was discovered that if a small industrial television camera tube is fitted with a quartz window in place of an optical glass flat, the camera tube was sensitive in the ultra-violet part of the spectrum. Thus, by illuminating the specimen with a very low power source of ultra-violet and attaching the modified camera to a suitable microscope, one not only obtains the normal microscope magnification but also the amplification of the television camera circuit. Moreover no time is lost in processing the photographic plate for an instantaneous picture is seen on the viewing monitor which can be photographed for future records.

This is a simple development of a piece of known industrial electronic apparatus applied in a novel way to solve a specific problem and is just one of many examples that could be quoted. Almost as recent is the public interest in the work on radio-astronomy and the tracking of satellites by the scientists at Jodrell Bank in Cheshire. The radio-telescope has opened up new interest in the heavens far beyond the possibilities of optical telescopes, and much of the success of the vast project is the direct result of using thermionic valves for purposes other than entertainment.

The future for new entrants into the electronic industry is bounded only by their personal aggressive interest in applications on land, below the sea and in the air. Never has an industry given such opportunities or made such demand for trained technologists, engineers, physicists and research workers.

11

SCOPE OF ELECTRICITY

By a Special Correspondent

For young people who have scientific or mathematical ability, who like to find out how things are made and work, or who find satisfaction inquiring into the realms of pure research, the electrical engineering industry provides a challenge as stimulating as any. Within 100 years, electricity has spread from Faraday's dynamo-electric machine to a multitude of uses in all types of industry and in the home. Today, the power that permits world industry to expand and standards of living to improve is generated from nuclear energy, water, steam, oil or the gas turbine, and in the foreseeable future electrical engineers will be needed to develop and apply these sources of energy.

Craftsmen and Technicians

To keep ahead of this widening responsibility, firms have devised training schemes to suit recruits of different academic attainments and varying aptitudes. Broadly, there are four main courses of apprenticeship training, planned with a flexibility of syllabus that allows transfer between the grades, depending on the ability and enthusiasm of the individual trainee.

The strength and future of the industry rests largely in the hands of its skilled craftsmen. For boys of 15 or 16—many of whom come through the secondary modern schools—with a good general education up to G.C.E. " O " level, there is a five-year craft apprenticeship. This equips them to become fully qualified machinists, tool-makers, instrument-makers, fitters or turners in one of many specialized branches of electrical engineering. Craft apprentices are normally recruited locally; they live at home during training, attend one day a week at their local technical college, and are paid at rates directly related to adult wages.

The newest grade of apprenticeship is that of technician. This has been established to encourage those young men who start with "O" level passes in at least mathematics, English and one approved science subject to qualify for work under the direction of professional engineers in a limited number of techniques. The technician course includes part-time day-release from industrial training to study for the City and Guilds Technicians' courses or the Higher National Certificate in Engineering. After training, the technician will be able to undertake responsible work where decision is required, as a member of a team working under a professional engineer.

For the student grade, apprenticeship begins between 17 and 19 years of age, lasts five years, and usually takes the form of a sandwich course of alternate periods of academic study at college and practical training at a works. The basic qualifications are G.C.E. " A " level passes in mathematics and physics, with " O " level passes including chemistry or physics and preferably English, or the equivalent academic standard laid down for the London University degree courses. Theoretical and practical training aims at a Diploma of Technology, a degree or other professional qualifications. The training pay is equivalent to a county major award for the university, and ranges from £305 to £409 a year.

From among its graduate and student apprentices the industry will select the technologists and scientists of the future—the directors of research and engineering and senior managers and administrators. Graduate apprenticeship lasts two years, generally beginning at 20-22. Qualifications are a degree or its equivalent in engineering, science or mathematics. Training includes workshop technology and experience in all the branches of a modern engineering undertaking—research, design and development, production and manufacture. If a young man wants industrial experience before he goes up to the university he may be accepted as a student apprentice for one year, and do his second year as a graduate apprentice at the end of his university studies. Training pay for honours graduates is £600 a year, for others £562.

Openings for Women

Parallel with the student and graduate training schemes for boys, some firms offer a limited number of apprenticeships to girls. Those who aim at full professional engineering status need " A " level passes for entrance to the university, where they will read for an honours degree in engineering, physics or mathematics, which will then be followed by a two-year engineering training. Alternatively, girls may prefer a five-year sandwich course divided between practical engineering and academic study at a technical college. The minimum qualifications here are two, preferably three, G.C.E. " A " level passes in pure or applied mathematics, with physics, chemistry or general science. Shorter courses are also arranged for women who are interested in a career as assistants in research and development, design calculation, or physical, chemical or metallurgical laboratories. The programme for these courses differs with the trainees' qualifications and the sphere in which they hope to work.

The future

For the electrical engineer, professional qualification has the same significance as in architecture, the law, or medicine. To those concerned with engineering throughout the world it identifies the holder as clearly as the passport does the traveller. The industry now invests many thousands of pounds each year not only in formal apprenticeship schemes, but in valuable scholarships and fellowships that allow the ablest young men with the best brains to pursue their chosen career without financial worry.

Opportunities will undoubtedly continue to increase as new horizons are opened by scientific advances in nuclear engineering, aerodynamics and electronics. Power generation and distribution for the new industrial countries, electric and diesel-electric traction for the world's railway systems, marine propulsion, aircraft and aircraft equipment, industrial electronic equipment, and electrical domestic appliances are but a few of the spheres in which the electrical engineer can find a stimulating and rewarding career.

12

IRON AND STEEL EXPERTS

BY

C. H. T. Williams

CHAIRMAN OF TRAINING COMMITTEE, BRITISH IRON AND STEEL FEDERATION

Entry from school, technical college or university

The iron and steel industry employs about 300,000 people and at least 6,000 of these are in the middle and senior staff ranks. Modernization has increased the proportion of technicians, technologists, and specialists of all kinds. The next phase of development plans, scheduled to be undertaken before the end of 1961, involves capital expenditure at a rate of over £2m. a week. The nature and extent of the developments will create even greater demand for such experts for the installation and control of plant.

Most entrants join straight from school at 15 or 16 years of age and after preparatory training enter the streams leading to process jobs and craft apprenticeships, or they become staff trainees. Process workers serve no formal apprenticeship, but receive education and training for posts that call for ever-increasing skills and responsibilities in line with technical advance. For the large number of engineering crafts in the iron and steel industry apprentices are specially selected and given a thorough training in the skills of the trade, with appropriate technical courses of part-time study.

Until about the time of the Second World War, production managers and many engineers worked their way up from these two grades of entrants, qualifying by practical experience and by evening classes and other study in their own time. For many years, however, education and works training facilities have been available for suitable young men to equip themselves as candidates for staff positions in engineering and production management. Now, changes in the country's educational system have resulted in a greater proportion of entrants from technical and grammar schools, public schools, and universities.

Those joining at the ages of 17 or 18 customarily seek appointment as staff trainees and form a potential source of technologists and managers. Most companies cater for these entrants within their staff training schemes, making available the educational facilities and providing on-the-job training to enable them to attain qualifications in their respective professions and a place on the ladder to senior appointments.

The educational facilities may start with part-time day-release combined with evening study. Some companies now arrange for these young men to attend a sandwich course at a college of technology or at a college of advanced technology, at either of which their studies might lead to the new qualification of Diploma in Technology. In this field the industry, through the British Iron and Steel Federation and in consultation with the educational authorities, has collectively instituted a new course in heavy metallurgical works advanced engineering at the Loughborough College of Technology. This course is designed to give a sound basic education in the subject, but has a syllabus wide enough to take into account the great variety of problems likely to confront an iron and steel engineer.

Entrants from the universities, engineers, metallurgists, chemists, physicists, mathematicians, and also some who have read arts subjects, find a great variety of opportunities. To supplement their university education before they take over their appointments it is customary to give them varying periods of practical training, in order to acclimatize them to the industry and its procedures. To the man who is prepared to take advantage of the facilities provided, there is, then, opportunity for advancement from all grades of entrants.

Further Study

Education and training are a continuing process. Almost all companies have planned schemes of training for their future senior staff and managers, including periods at residential courses organized by the British Iron and Steel Federation. Certain of the larger companies also have residential courses of their own. It is perhaps a special feature of the iron and steel industry that it makes this effort to continue management development for suitable members of staff throughout their careers. It was the first to establish residential management courses on a cooperative basis at its own centre at Ashorne Hill in Warwickshire.

In addition to the visits arranged by companies to works at home and abroad for the education of members of their staffs, the industry administers an exchange scheme with corresponding organizations on the Continent, under which some 100 young executives from this country are exchanged for four weeks every year with a similar number from eight European countries.

A young man entering with the aim of reaching higher levels will first need to prove himself skilled in the techniques of his appointment. In order to progress he must develop personal qualities of leadership, ability to accept responsibility, and judgment in taking decisions. There are many and varied opportunities over a wide range of occupations and a challenge for the man of ability and character.

Applications for entry should be made to individual companies, but inquiries may be made to the Training Department of the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

13

WORKING WITH THE NEWER METALS

BY

G. L. Bailey

NON-FERROUS METALS RESEARCH ASSOCIATION

The importance of metallurgy in the advance of civilization has been increasingly realized in the past 100 years, but it has only recently been appreciated that many industries, such as transportation, power generation and telecommunications, largely depend for their progress on metallurgical developments. Improvement of the jet engine, the aircraft or the nuclear power plant depends in part on metals and alloys superior in some respects to those now known.

Metallurgy comprises the extraction of metals from their ores, the preparation of innumerable alloys, and the shaping of these materials ready for use by the engineer. The non-ferrous metallurgical industries cover all the metals and alloys except iron, steel and ferro-alloys. Extraction is mainly carried out oversea, where the ore body is situated; but the newer metals like titanium and uranium are to an increasing extent being produced in the United Kingdom. The metallurgical works in this country generally import the raw metal and, with or without alloying, shape it by such processes as casting, rolling, forging and extrusion. These operations offer a great variety of interest and opportunity both at home and abroad.

While the first requirement of the industry is that it should supply its current products in the forms and at the prices required, its parallel duty is to improve those products and the efficiency of industrial operations. It is, perhaps, these secondary objectives that make the work of the metallurgist of such outstanding interest. He may be employed in supervising production operations or carrying out experimental investigations. In either case, he has opportunity to advance production efficiency, but the development of new materials is more likely to result from laboratory investigations, with the production staff finding out how to make an alloy shown to possess attractive properties. Scientific work of a high order is carried out in the laboratories of industry, Government departments, the industrial research associations and the universities. Metallurgical research requires the most advanced scientific knowledge and up-to-date laboratory techniques: it is satisfying to the most competent scientific brain.

The best starting points

How are metallurgists trained? For the student who has obtained a General Certificate of Education with passes at the Advanced level in chemistry, physics and mathematics, there are several avenues to a metallurgical qualification. Full professional standing is ensured by admission to one of the grades of membership of either of the two professional institutions—the Institution of Mining and Metallurgy and the Institution of Metallurgists. This requires the attainment of appropriate examination standards together with two or three years' practical experience and responsibility. Several courses of study are available. Those mentioned below are not necessarily all satisfactory to the professional institutions, whose rules would-be members are advised to study.

A university degree is the obvious first choice. Alternatively, the new Diploma in Technology, approved by the National Council for Technological Awards (Dip. Tech.), can now be taken after either a full-time course in a college of advanced technology or a sandwich course involving about six months in the works and six months in college each year for a period of four or five years. The qualifying examinations of the professional institutions can also, of course, be taken directly.

The Higher National Certificate in metallurgy can be taken by holders of an Ordinary National Certificate after two further years at a technical college, through evening class study combined with part-time day-release by the employer. This qualification is of value in itself to the potential metallurgist, and for those who cannot take either a full-time or sandwich course offers the best starting point, since the taking of an external degree of London University by part-time study has become so difficult as to discourage all but those of outstanding ability. A Higher National Certificate of a sufficient standard or the Full Technological Certificate of the City and Guilds of London Institute are accepted by the professional institutions as exempting from certain subjects in their own examinations, and the student can then take additional subjects and secure the equivalent of a pass in the institution's own examinations. Thus, while the two main groups of qualifications are distinct, there is a bridge between them.

14

MINING METALS ABROAD

BY

B. W. Kerrigan

SECRETARY, INSTITUTE OF MINING AND METALLURGY

The industries of the world depend on the metals and other minerals obtained from the earth's crust. The need for these products is as vital and as permanent as our need for those of agriculture. Iron, copper, lead, zinc, tin, nickel, diamonds and other minerals in common use are consumed in enormous and increasing quantities—we have probably used up more in the past 50 years than in the whole of history—while technological advances constantly add new requirements to the list—uranium for nuclear power, titanium for jet engines, and many others.

It is the task of the mining industry to provide these essential materials. Britain does not at present produce any large quantity of minerals, apart from coal, but British enterprise and capital have established mines and plant in all parts of the world, particularly in the countries of the Commonwealth, many of which are rich in mineral resources. The choice is wide: South Africa, Rhodesia, Malaya, Canada, Australia, Mexico, Peru, Portugal—to name only a few.

Engineers and geologists

The man who takes up mining enters a world-wide industry, with the great scope for his abilities that this provides, and the opportunity to know and appreciate many different countries and peoples. He should be healthy, self-reliant, and ready to take responsibility.

The business of mining covers the discovery of mineral deposits, the extraction of minerals from the ground, and the processing or " dressing " of what is extracted. The *mining engineer* is trained in all these branches, and though his main concern is with mining the ore-bearing rock, he usually finds he must use his knowledge of prospecting and mineral dressing during his professional life.

Nature has provided an infinite variety of deposits, some deep in the ground, others on or near the surface; some dispersed over a wide area, others concentrated in narrow veins. To each the mining engineer must bring the appropriate method. He deals with problems of drainage, structures, road-making, and the operation of large machines for excavation and the removal of earth. Most important of all, he is in charge of men, responsible for their safety and efficient working.

To his technological skill the young mining engineer is encouraged to add a knowledge of business organization and the economics of his industry to fit himself for posts as assistant manager or manager of a mine. In these he finds himself with a greater variety of responsibilities than in most professions.

Satisfying careers can also be made by specialists in either mining geology or mineral dressing. The *mining geologist* has taken the place of the old-time prospector, by whose efforts most of the more easily recognized deposits were found. He applies the principles of geology to the search for minerals, deciphering the geological history and structure of an area, either to locate a deposit or to judge the nature and extent of one already found. For success he must combine a researcher's attitude of mind with a grasp of practical and financial issues. It is an active outdoor life and demands good health and the ability to get along with a wide variety of people.

The *mineral dressing engineer* is concerned with the treatment of ores and mineral products in order to concentrate their valuable constituents, separating the useful from the waste products, and one useful product from another, in a complex ore. Great developments have taken place in mineral dressing over recent years, because the world's need for metals has caused low-grade and difficult amalgamations of deposits to be mined. To a basic engineering training the mineral dressing engineer adds studies in geology and in applied chemistry and physics. It is a field with opportunities both for fundamental research and for work in large operational plants.

Training and Salary

Normal entry to the mining industry at the professional level follows a three or four years' course at a university or school of mines, and courses are available at the following:

The Royal School of Mines, Imperial College of Science and Technology, University of London.

Camborne School of Metalliferous Mining, Camborne, Cornwall.

The Royal College of Science and Technology, Glasgow.

The Heriot-Watt College, Edinburgh.

The Universities of Birmingham, Durham (King's College, Newcastle upon Tyne), Leeds, Nottingham, Sheffield, Edinburgh, Glasgow, and Wales (University College, Cardiff).

Candidates should write to the registrar at the university or college for details of entry qualifications; a grounding in mathematics, physics, and chemistry is always required.

A feature of the training in mining engineering, mining geology, or mineral dressing is the provision of practical experience oversea during the long vacation; the student will usually be able to arrange this without expense to himself.

Apart from State and local authority awards that can be held at the universities and mining schools, a number of metalliferous mining scholarships are offered at the Royal School of Mines each year. Selection is based upon academic record and personal interview. Application should be made to the Registrar, Imperial College, London, S.W.7. The British Overseas Mining Association recently announced its decision to introduce a number of awards for students of mining subjects, and details of the scheme, it is understood, will be published soon.

As the cost of living differs so much in various countries, uniform salary scales for the mining industry cannot be quoted. It is fair to say, however, that the general level of salaries and prospects of advancement compare favourably with those in other professions. As a rough guide one might take the following pattern as applicable to a man of average ability:

Age	Salary range (in United Kingdom terms)
24-27	£750-£1,200
28-33	£1,250-£1,800
34-45	£1,800-£2,500
45 onwards	£2,500 upwards

Income tax oversea is generally lower than in Britain, and companies frequently provide housing and recreational facilities at low cost.

The man of more than average ability can, of course, earn very much more than the salaries quoted. The managers of large mines, consultant geologists and mineral dressing engineers on the staffs of companies are very well paid. It is also increasingly common for managers who have served their companies well to be appointed to the board of directors.

15

TRAINING ALL KINDS OF MECHANICAL ENGINEERS

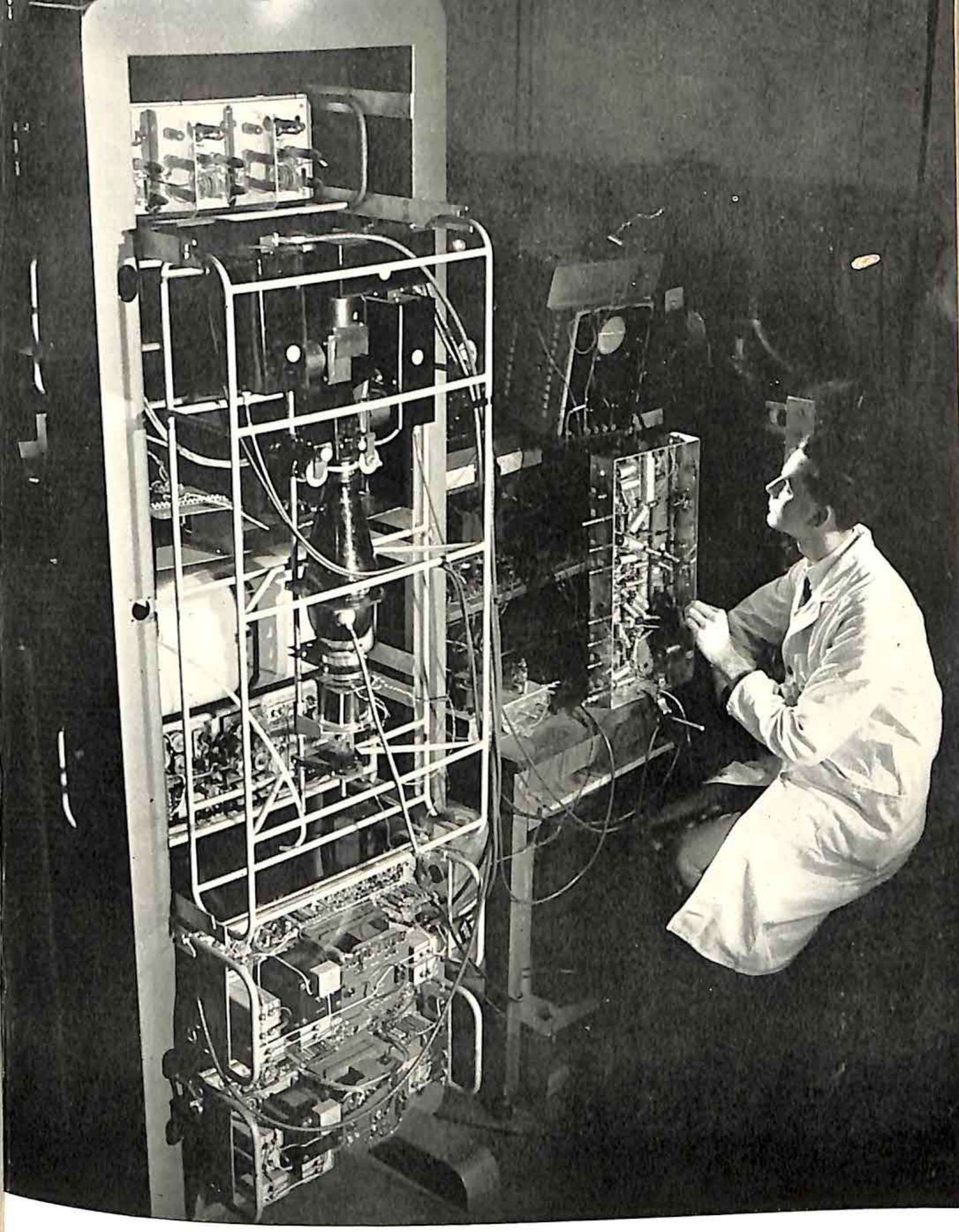
BY

H. G. Conway

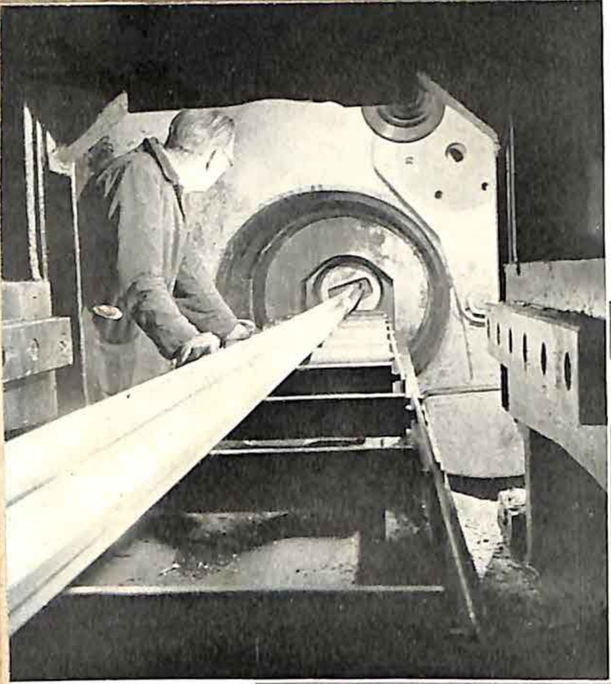
MEMBER OF COUNCIL, INSTITUTION OF MECHANICAL ENGINEERS

Of all the branches of engineering perhaps mechanical engineering offers the widest variety of careers. A mechanical engineer can be at heart a mechanic with a natural love for machines, or a first-class honours scientist from a major university; in either case he may attain an eminent position in his profession such as managing director of a large factory. He may become a designer of machines, a research worker in the atomic energy field or on long-range rockets, a production engineer on precision instruments or motor cars or steam turbines. He may be engaged on installing pipe-lines or machinery at an oil well in the desert or on the maintenance of steam or diesel locomotives on a railway.

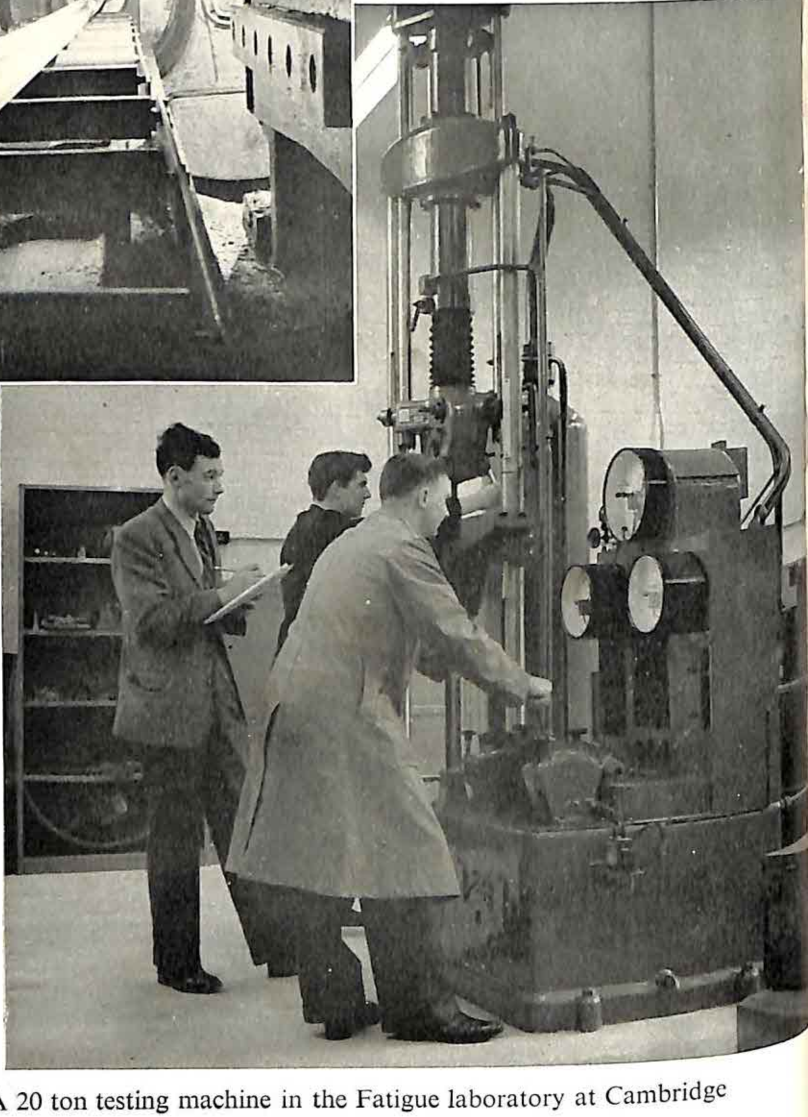
Mechanical engineering is found in many other branches of practical engineering. Much of electrical engineering is mechanical, and it has often been said that if the successes of electrical equipment are due to the electrical engineer the failures are frequently due to the poor design of the mechanical engineering parts; it is certainly true that in the electrical engineering field there is much need for the skill of the mechanical engineer. In the civil engineering field great progress has been made possible by developments in machinery and handling equipment; the speed with which modern civil engineering is carried out can largely be attributed to the development of improved mechanical equipment.



11. Adjusting a T.V. scanner at the Mullard Research Laboratories



12. An extrusion emerging from a die at the British Aluminium works



13. A 20 ton testing machine in the Fatigue laboratory at Cambridge

There is no doubt, therefore, as to the opportunities offered to the young man for a career here; the practical difficulty that presents itself to him or his parents is to choose an avenue or direction to take if one does not suggest itself automatically. Many young men make up their minds at an early age, but perhaps just as many are unable to decide more definitely than that they want to become " engineers ". These boys should be encouraged to specialise in mathematics, physics and chemistry at school rather than classical subjects. If the boy is fortunate enough to be able to contemplate going to a university a final decision can be delayed, although in most universities it would be necessary to distinguish between mechanical, electrical or civil engineering at least at some stage during the course. This applies to some extent to the industrial student apprentice, and to a lesser extent to the trade apprentice, but in both these cases the parents may be faced with entering the boy into a firm chosen for convenience rather than for its particular branch of engineering.

Too much attention should not, however, be paid to specialization at a very early age, and the broader the training can be the better. Indeed, if preference had to be given to a particular branch of mechanical industry it might be in the direction of the heavy side, where the basic arts of engineering are more likely to be found, than in some of the more highly specialized sections of the mass-production industries.

Three basic methods of entry

The three basic methods of entering are generally known as the trade, student, and graduate apprenticeships. For a trade apprenticeship the boy will enter industry on leaving school, at the age of 15 to 16 years. His training will begin at 16 and will be spread over five years. Full opportunity will be given to attend classes at a technical college for one whole day a week on day-release, as well as for one or two evenings, so that a boy with intellectual ability need have no fear that he will not be able to work for high academic qualifications. Normally, however, most of these boys will endeavour to obtain either a Certificate awarded by the City and Guilds of London Institute or an Ordinary National Certificate in Mechanical Engineering, and they should be encouraged to do so. The brighter boys will continue to study and can reach Higher National Certificate level.

The student apprentice leaves school between the ages of 16 and 18 and attends a four- or five-year course, either with part-time day-release to the local technical college or in some cases by the sandwich scheme, which today is increasing in popularity. The arrangments for the latter vary, but a typical method is six months of each year in a factory followed by six months at a technical college.

Graduate apprentices were, in the past, those who had spent three or four years full-time at a university and then joined industry for two years' practical training. It has been felt by many that this division of the training into a theoretical period followed by a practical period does not give the best experience to the young engineer because the two should go hand in hand, the theory and practice being coordinated just as laboratory work follows chemistry theory during the boy's schooldays. An excellent scheme is to give the young engineer one year in industry before going to the university, followed by a further year after graduation, and in any event further practical experience should be gained during vacation periods. Many young men have found that even short periods of experience in different industries or factories can be valuable. An opportunity to spend a few months at a factory abroad, or at sea, should not be missed.

If average employers were asked the qualities they hoped to find in the young aspirant some would say that enthusiasm and interest in the work were often more important even than high theoretical skill. Many young engineers do not know how to make the best of their own natural abilities and fortunate indeed is the young engineer who not only has theoretical ability but knows how to make the best use of his own aptitudes. Many fail to realize that it is not enough to have ambition and the desire to earn a good salary. The engineer must be prepared to work steadily towards his goal and earn success.

Design and production

In mechanical engineering there is scope for all kinds of young engineers. There are possibilities for the young man who is naturally creative—he can become a designer—but he must be prepared to learn the practical arts of engineering; today a designer must be much more than a draughtsman, and a man with real ability who enjoys working "on the board" can easily earn a high salary. There is scope for the engineer whose mind tends to be thoughtful and inquisitive—he can become a research or experimental engineer; at no time have there been better opportunities for the research engineer than today, so rapid is the progress of technology and so rich the rewards for new ideas. And research in this context does not only mean the finding of new solutions; it includes the practical development of them to a stage where they can be used.

If the young engineer is interested in manufacture, he should become a production engineer. It is perhaps a major criticism of British industry that there are not enough academically trained production engineers in the typical modern factory, and the scope for the young man who is prepared to find out and study the best methods of manufacturing engineering products is excellent. Here again, an interest in and aptitude for the work may be of more importance than the level of academic qualification, although the advantages of the training and discipline of the mind that theoretical study gives must not be overlooked. There is scope for the man who likes variety and travel in the maintenance and operation of plant and equipment. In this age of automation processes are becoming more complex and the running of plant more involved thereby making more acute the shortage of trained engineers capable of keeping it in good running order and dealing with difficulties.

Institution membership and practical experience

The senior professional body representing mechanical engineers is the Institution of Mechanical Engineers, which was founded in 1847 and now has a total membership of about 50,000. Corporate membership of the Institution is aspired to by most mechanical engineers and to be a Chartered Mechanical Engineer is something to be proud of.

An applicant must have received adequate education in science and technology at some technical college or university and be able to pass, or be exempt from, the Institution examination. He must have received basic practical training in industry or in a college workshop and enough practical training on the shop floor; and in order to qualify for Corporate Membership he must have held a position of responsibility as a professional mechanical engineer.

The young man who intends to become a Chartered Mechanical Engineer should join the Institution as a student or graduate member at as early an age as possible.

The Institution has kept rigidly to its requirements for academic and practical training, although in recent years it has been adapting its requirements for practical training to meet the present-day needs of industry. In former times it was felt that at least two or three years' practical shop experience in a factory was necessary for all engineers, but today there are many who feel that a degree of flexibility is required and who would agree that two years on the factory floor may not be necessary for many engineers, particularly for those of high academic standing. Recent investigations at the Institution have shown the need for more concentrated training to impart some of the basic practical training which all mechanical engineers should undergo, and at the same time it is felt desirable that those who wish to take up research work should be able to do so after rather less than two years' shop floor experience. Some months' experience in the factory itself is essential, but there is also much to be learnt in the technical and production offices.

Apart from the obvious advantages to be gained from first-hand experience with machine and other production processes—and it is surprising how much insight into a process can be gained even with a few weeks' experience on a lathe, in a foundry, or in a test department—it is essential for all young engineers to have contact with the factory worker at his own level. There are many managing directors or chief engineers today who would say that months spent in their youth on the factory floor under conditions of social equality with the working man were months of great interest and of inestimable value to them in later life. Fortunate indeed is the " boss " whom the workers respect because they know that he could " show them a thing or two ". Such men are rare, but a manager will gain respect the more easily if he understands his men's problems from first-hand experience with them.

Typical Careers

A few examples of careers may serve to conclude: those of three typical men from different walks of life but each at the top of the mechanical engineering profession.

The first joined a large factory on the outskirts of London as an ordinary apprentice—in those days earning a few shillings a week. Five years' experience taught him a great deal, although the opportunities for theoretical training were not as good then as now, and he did not obtain any qualifications better than an

Ordinary National Certificate. But his natural intelligence, good memory, and ability to get jobs done when asked (and later on to see " the wood for the trees ") soon saw him chosen as a chargehand, then foreman. During the war years he went rapidly from superintendent to manager, assistant general manager, and today general manager with a good income and responsibility for several thousand workers. As his status in industry grew, so did his social status improve.

The second man was a public school boy, good in mathematical subjects but not good enough to want to go to a university; he left school at 18 and became a student apprentice at a large Midlands factory. Hard work, interest in the work and an obvious ambition brought him to the attention of the apprentice supervisor, and when working as a young engineer in the test department he was promoted to assist in a new department of the firm which was being started up. Before long he was chosen to be the senior design engineer in this department, and a year or two later became its chief engineer. Six or seven years' successful work in this department showed up his qualities and he was promoted as company chief engineer. Later he was appointed to the board.

The third man was also a public school boy and read for an honours degree in Mechanical Science at Cambridge. Then followed two-and-a-half years as a graduate apprentice at a nominal wage where he managed to meet the working man on terms of social equality—not easy for many university trained men. Chosen on ability to lead an engineering group in the design department, he followed a new product from the design to the production stage. Leaving this firm to obtain new experience, he became assistant chief engineer and later chief engineer of a small factory and built up a reputation based on the excellence of the products of the firm. A few years later he was appointed chief engineer of a large group of companies, then received a seat on the board, and ultimately became managing director.

Today, more than ever before, it is true to say that a boy who has the ability to take advantage of the excellent facilities available for technological education and industrial training can, with drive and enthusiasm, scale the heights of this profession. In doing so, he not only has a fascinating career but also helps to meet the ever-increasing national need for more mechanical engineers.

16

ENGINEERING IN NUCLEAR RESEARCH

BY

J. R. V. Dolphin

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Many people seem to think that most of the work at a nuclear research establishment is purely scientific and that the engineer plays a secondary and somewhat unimportant part. This is far from being the fact, as nearly half the staff at a nuclear research establishment are likely to be in its engineering division, and engineers play a most important part in scientific advance.

The construction of a nuclear research station follows normal factory construction for main workshops and offices, but also involves a number of specialized problems of great interest, covering a very wide field. In general, the scientist merely states his requirement, leaving the engineer to do the design and construction to meet it to the best of his ability. Among the specialized problems are the design and construction of laboratories for handling radio-active materials. These necessitate working areas for frogmen, shielding, remote handling and manipulating remotely controlled machines, special ventilation and filtration and a hundred and one associated problems.

Special plant for dealing with radio-active waste must be designed and built; and it may be necessary to provide an active discharge line to the sea, involving numerous pumping problems and laying concentric pipes a mile or two out to sea, to guard against any possible hazard from leakage.

It may also be necessary to design many different types of reactors to the scientists' requirement, and subsequently build, maintain and operate them. Special buildings are also required for zero energy experiments. The buildings themselves are designed to accommodate a number of reactor test facilities, so that physicists, metallurgists and other scientists may check their theories.

There is a big engineering field in the design and construction of loops, which are devices inserted in an operating reactor to simulate under radiation conditions a more advanced type reactor. Loops are at present very complex in design and involve a great deal of engineering ingenuity in order that this simulation can be effective and give positive results. The sort of problems involved are heat transfer, effect of radiation, gas flow conditions, and temperature effects. The elaborate instrumentation needed in these investigations presents a problem in itself.

A number of special machines for nuclear research may also have to be designed and installed: for example, linear accelerators, proton synchrotrons and the like. These machines involve, in many cases, major civil works, major electrical problems in dealing with very high voltages and currents and, because of their size, many interesting handling problems. To quote one example: at the present time a 7,000 million volt proton synchrotron is being constructed for the National Institute of Research in Nuclear Science. Though the scientsts give the technical specifications and solutions to the numerous theoretical problems involved, the actual design and construction is undertaken by engineers working in closest association with them. For this particular machine it was first necessary to dig a hole some 150ft. in diameter and 60ft. deep, necessitating the removal of 150,000 tons of chalk. A very heavy foundation had to be laid to accommodate a circular magnet weighing some 7,000 tons, comprising 350 segments, each of approximately 20 tons, built up of quarter-inch thick steel plates with suitable electrical characteristics.

This magnet has to be assembled to a few thousandths of an inch to have the correct electrical characteristics; precision inspection and most comprehensive electrical testing are thus necessary. For the installation of such a magnet it is necessary to design and install special circular cranes. The building will then be covered with a reinforced roof, and 150,000 tons of chalk put back on top of that to provide proper shielding. Associated with the magnet is a very large electrical installation, an accelerator, an injector and other equipment. In addition, workshops, laboratories, and so on, all for this project alone, have to be designed and built.

Advanced machines such as Zeta, the controlled thermonuclear reactor, though entirely envisaged by scientists, who also provide the basic design data, have to be built and serviced by engineers.

Though this brief résumé covers only a fraction of the engineering problems that arise at a nuclear research station, it will be apparent that there are careers of great interest for all types of engineers. Engineers with a very strong theoretical background are urgently needed for new projects such as Zeta. Electrical engineers also have to deal with proton synchrotrons, linear accelerators, and the day-to-day provision of all electrical services. Specialists in electronics with an engineering background are required for instrumentation. Civil engineers are required for the many constructional problems. Mechanical engineers are required for every phase of the work, and a great deal of intricate design of a complex and most interesting nature crops up daily.

Training after school or university

What are the methods of starting a career at a nuclear research station? First of all, such establishments have comprehensive apprenticeship schemes for boys with a genuine interest in engineering, whatever their educational background. Those who wish to use their hands rather than their heads can apply for a craft apprenticeship, for which there is an aptitude test and an interview. Such boys are normally taken in at the age of 15 to 16½ and spend their first year in well-equipped training shops with expert supervision; then they pass into one or more of the wide range of workshops associated with an atomic establishment. The course lasts five years. During their practical training they also spend up to one and a half days a week at a technical college and normally qualify for the Ordinary National Certificate.

The student apprenticeship scheme is planned for boys who intend to become qualified engineers. An entrant must have passed G.C.E. in five or more subjects including at least two " A " level subjects. Such boys are usually accepted from the age of 17 to 18½ and spend their first year in the Apprentice Training School, after which they are trained in the workshops, in the drawing offices and on projects. Student apprentices are allowed two days a week for theoretical studies at technical colleges, and many qualify for full-time university courses. Alternatively, they may qualify for a sandwich course at a college of advanced technology, spending six months at college and six months at their parent establishment each year. It should always be possible for such students to obtain a degree or to qualify for one of the senior institutions, which fits them for an engineering career.

There is also a post-graduate apprentice training scheme for graduates who have completed their theoretical training at a university. For those who are already qualified professionally, entry to an atomic energy establishment is obtained through the normal procedure of board interview. The minimum qualifications are associate membership of one of the major institutions or a degree, preferably an honours degree.

It is not by any means necessary for all those seeking employment as engineers in an atomic energy establishment to be brilliant. There are the normal daily jobs of running any large factory to be dealt with, power stations to be run, and many jobs of a more routine nature. Though this work is routine, it is essential, and it is most important that it should be done conscientiously and efficiently. Once trained, an engineer should be capable of adapting himself to any particular problem as it arises. The problems associated with atomic energy, though new, are just as capable of solution as the more normal engineering problems; but, because they are new, they tend to be more interesting and to provide a challenge that should be eagerly accepted.

Anyone seeking an engineering career dealing with problems that present a challenge should consider nuclear engineering very carefully. He must remember that there are few, if any, available textbooks to aid him, and he will be forced to back his own judgment far more frequently than in more pedestrian careers; but this is the fascination and absorbing interest that makes life worthwhile. When one adds to this career good working conditions in really well-equipped establishments, fair pay and good holidays, one probably has almost the ideal job; but it is hard work and needs self-confidence as well as ability.

17

BUILDING AND CIVIL ENGINEERING

BY

Sir Richard Costain

With an annual turnover of more than £2,000m., civil engineering and building in Britain today have assumed enormous proportions. Building construction alone accounts for about one million workers. The great national contractors, who each employ thousands of men, are undertaking major projects in many different parts of the world.

In the United Kingdom the construction industry is represented by some 110,000 firms, of which nearly 60,000 undertake general building and civil engineering work, the remainder being specialists. Of these 60,000, only about one-tenth employ more than 20 men. The specialist firms undertake a variety of work, *e.g.*, heating and ventilating, structural steelwork, reinforced concreting, plumbing, plastering, and painting. Here again, the number of firms employing more than 20 men is small, amounting to a mere 2,000. A further analysis of the labour distribution shows that 75 per cent. of the total labour force is employed by the 8,000 largest firms in the industry, *i.e.* those with more than 20 men. Opportunity thus lies with the large contractor.

At one time building was solely a craft industry. It still needs the craftsman. Mechanization, however, is fast ousting many of the old trades, leading in turn to higher efficiency. Mechanization needs accurate planning, which requires the best minds to develop it.

Even more important, perhaps, it demands a high degree of leadership of the whole building team. If the industry maintains its present rate of progress, an ever-increasing demand for young men of the right type to take up building careers can be expected.

Many of the larger contractors have given this matter serious consideration and now provide complete training schemes for executive posts. To find young men capable of being trained to carry on these responsibilities requires special care. The potential manager needs a long period of training—up to five years—before he is ready to take even small responsibility either at home or abroad. This would be gradually built up to the control of a contract for a complete township—houses, schools, hospitals, power stations, roads and services—such as at Kariba, in Central Africa, a contract of £3,500,000.

Steps to administrative positions

What then is basically required of the manager in the building and civil engineering industry? Primarily, he must have a sufficiently high standard of education on which to base sound technical training and practical experience. Next he must have the capacity for management and supervisory responsibilities; and lastly the ability to handle men. Management training must play a considerable part in his practical training.

In my own company we have, for several years now, been organizing training schemes to provide first-class building managers and assistants, estimators, surveyors and contract agents. What qualities do these executives need?

A sound knowledge of construction is essential to the building manager. At the same time he should know something about quantity surveying, estimating, external and internal organization, and, in addition, have a basic knowledge of surveying and architecture. Above all, the building manager must possess a high level of common sense and integrity.

The knowledge required of a contract agent is similar to that of the building manager, but does not need to be so extensive. However, site administration and really sound experience are essential. Estimators and surveyors must be fully acquainted with construction, quantity surveying and estimating and the preparation of final accounts and specifications; they must also have knowledge of internal organization and contract law and a working understanding of contract costing, which will enable them to relate cost to output.

Training new entrants

A newly appointed trainee undergoes a probationary period of six months which, if satisfactory, leads to a five-year pupilship. The successful candidate now circulates through sites and the various departments—personnel, purchase and supply, accounts, the drawing office. During this time he is required to attend either part-time day or evening classes with a view to obtaining a Higher National Certificate of Building, and later taking the Institute of Builders' examination.

At regular intervals the pupil himself prepares a report for the company training officer covering the work he has been doing. Progress reports are also made by his head of department. School reports are checked to help in assessment. Promising material is thus not likely to be overlooked. We have also introduced an annual conference where trainees have an opportunity to meet the directors and senior staff. This has proved of great value, and it also enables the trainees to meet and get to know each other.

In order to provide further education for those showing promise, the company has introduced a scholarship system enabling the selected pupil to study for a building degree at Manchester University. Opportunities are also given for attendance at full-time sandwich courses at a school of building.

After training has been completed, the trainee probably undergoes a couple of years' contracting experience. This may consist of site control of a small contract or equivalent responsibility in surveying and estimating and it generally proves invaluable. Further experience may be gained if the pupil is included in an oversea building project.

Rates of pay compare favourably with other professions, the trainee getting £600 a year on completion of deed, plus a generous subsistence allowance when living away from home. Rates of pay oversea are correspondingly higher. Thus, a successful young man of about 30 years of age could expect a salary of £1,350 a year in the United Kingdom, and certainly more abroad.

The major companies are undoubtedly making a very great contribution to the future of the industry through the various schemes they offer to young men. As with any other major industry, future management efficiency depends very largely on the selection, education, and practical experience of those at present entering an industry on which our national economy so largely depends.

18

CRAFTS AND CAREERS IN THE SHIPYARDS

BY

Robert W. Johnson

VICE-PRESIDENT OF THE SHIPBUILDING
EMPLOYERS' FEDERATION

To an island race like ours shipping has always been and will always be of the utmost importance. It is our life-blood, bringing our raw materials and foodstuffs from abroad and enabling us to send out goods to other countries in exchange. The country is directly dependent on the shipbuilding industry for the construction of ships of all types and on the ship repairing industry for the maintenance of ships in commission in a good state of repair.

The expansion of world shipbuilding has given rise to increasing competition from abroad, and the challenge to this country's supremacy is reflected in its recognition of the vital necessity for the shipyards to keep fully abreast of the rapid technological changes that are taking place.

The industry is concerned with a very wide variety of craft, ranging from luxury passenger liners, passenger/cargo liners, cargo ships, tankers, coasters, trawlers and various types of fishing vessels down to the small sailing ships, cabin cruisers and motor launches seen at all seaside resorts around our coast—apart, of course, from naval craft of all descriptions, which are built by many of the private shipbuilding firms. There are over 70 shipyards in the United Kingdom, some of which have their own engine-building works, and about 300 small boat-building yards. Some shipyards also repair and service ships in commission, and a considerable number of firms are engaged solely on ship repair work.

The shipbuilding and ship repairing industry affords a fascinating and worthwhile career for those who have the right intellectual and physical calibre and are interested in ships—whether it be design, actual building of the vessel, or the management and executive side.

The Executive Side

For those wishing to make a career on the management and executive side there is a National Scheme of Shipbuilding Apprenticeships designed to qualify apprentices for future executive and administrative positions in shipbuilding and ship repairing. Most shipbuilding companies participate in this scheme, which is sponsored and administered so far as selection is concerned by the Shipbuilding Employers' Federation. The scheme is available to boys of 17½ years of age from the public and grammar schools who possess the G.C.E. at " A " level in mathematics and physics or chemistry.

The successful applicant under this scheme of entry is expected to proceed either to King's College, Durham University, or to the University of Glasgow to read Naval Architecture, after he has completed one year of practical training in the shipbuilding establishment to which he has been assigned. During the university vacations he returns to the shipyard to continue his training. A further year's experience after he has graduated completes his formal training. There are many opportunities for such a young man to rise eventually to a high-level position in shipyard management or design, provided he maintains enthusiasm for the work and shows a high degree of adaptability.

The main source of recruitment for ship and yard management leading eventually to shipbuilding manager is the ship drawing office, and consequently a boy who enters at this level can be confidently assured of a highly interesting and successful career. Shipbuilding firms generally require a boy to sit a competitive examination before he is accepted for a five years' apprenticeship to ship draughtsmanship.

Since no practical field of endeavour is complete without theoretical or technical training, the ambitious ship drawing office apprentice pursues a course leading to the Higher National Certificate in Naval Architecture. Opportunities open to the qualified naval architect include positions of responsibility in the design offices of shipbuilding firms, or as naval architect to a shipbuilding or shipping company, as well as appointments with Lloyd's Classification Society or with the Ministry of Transport.

Craft apprentices

The training of trade or craft apprentices has always played a prominent part in a yard's activities and indeed many high positions in the shipbuilding, ship repairing and marine engine-building industries are occupied by former craft apprentices. For those who do not aspire to that level, there are always opportunities for promotion as charge-hand or foreman.

The crafts available on the shipbuilding side cover a wide range of activities from the basic trades such as shipwright and plater to what are known as the finishing trades—joiner, shipfitter and electrician. Marine engine-building provides training for boys who wish to follow engineering trades such as engine fitter or turner machinist. In all cases apprenticeship, whether on the shipyard or engineering side, begins at about the age of 16 and lasts five years.

Day-release is now an established policy in the industry, and all trade apprentices are encouraged to pursue further education in the appropriate technical subjects, leading to the examinations of the City and Guilds of London Institute or, if they show extraordinary promise, to the Ordinary or the Higher National Certificates and diplomas.

Apart from the opportunities for a successful career in manufacture, design, and production/planning control for trade apprentices who obtain the Higher National Certificate, membership of the appropriate professional institution is open to those with the necessary technical qualifications and experience. Opportunities to transfer to the more advanced forms of marine engine-building apprenticeships described below are usually available to engineering apprentices who show promise in their practical and theoretical training.

Marine engineering and architecture

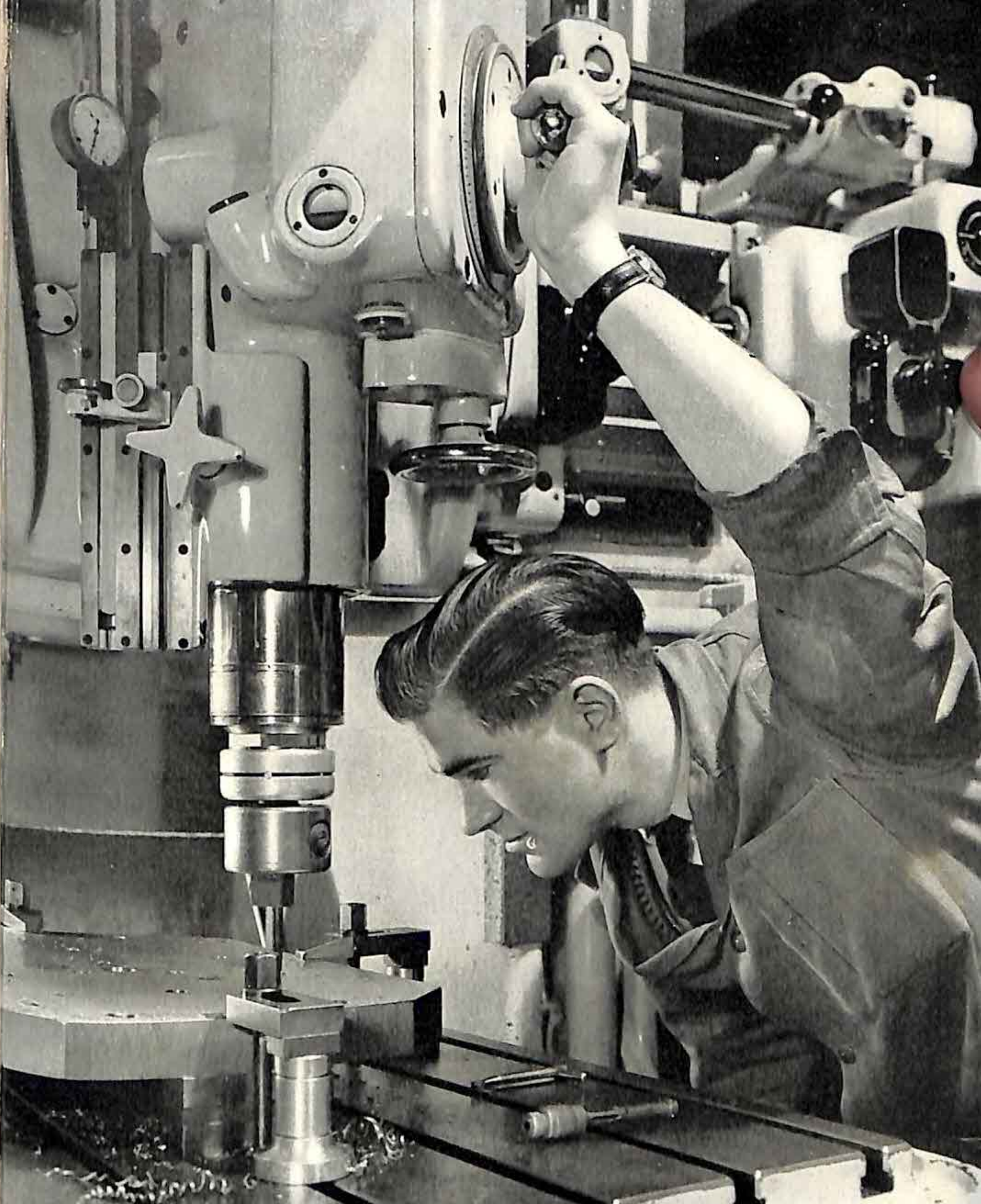
For boys who wish to pursue a career in engineering, individual shipbuilding and engine-building companies offer various forms of apprenticeship, all of which are of five years' duration, and combine a sound practical training with the acquisition of technical knowledge.

First, there are the " student " or " pupil " apprenticeships designed for the boy between 17½ and 18½ who has attained G.C.E. at " A " level in mathematics and one of the sciences (such as physics or chemistry). Usually these apprentices, in addition to being given a good practical grounding in the various departments of the firm, attend full-time courses of study either at a university or an approved technical college with a view to attaining a degree or a National Diploma in Engineering. The precise programme of technical and theoretical training depends on the timing of the courses of the university or technical college. Thus in some cases six months' practical training alternates with six months' theoretical studies throughout the period of the apprenticeship. In others, the first 12 months are spent in the works, followed by three years at university, the long vacations being spent in practical training and the final year being devoted to acquiring further practical experience in the works.

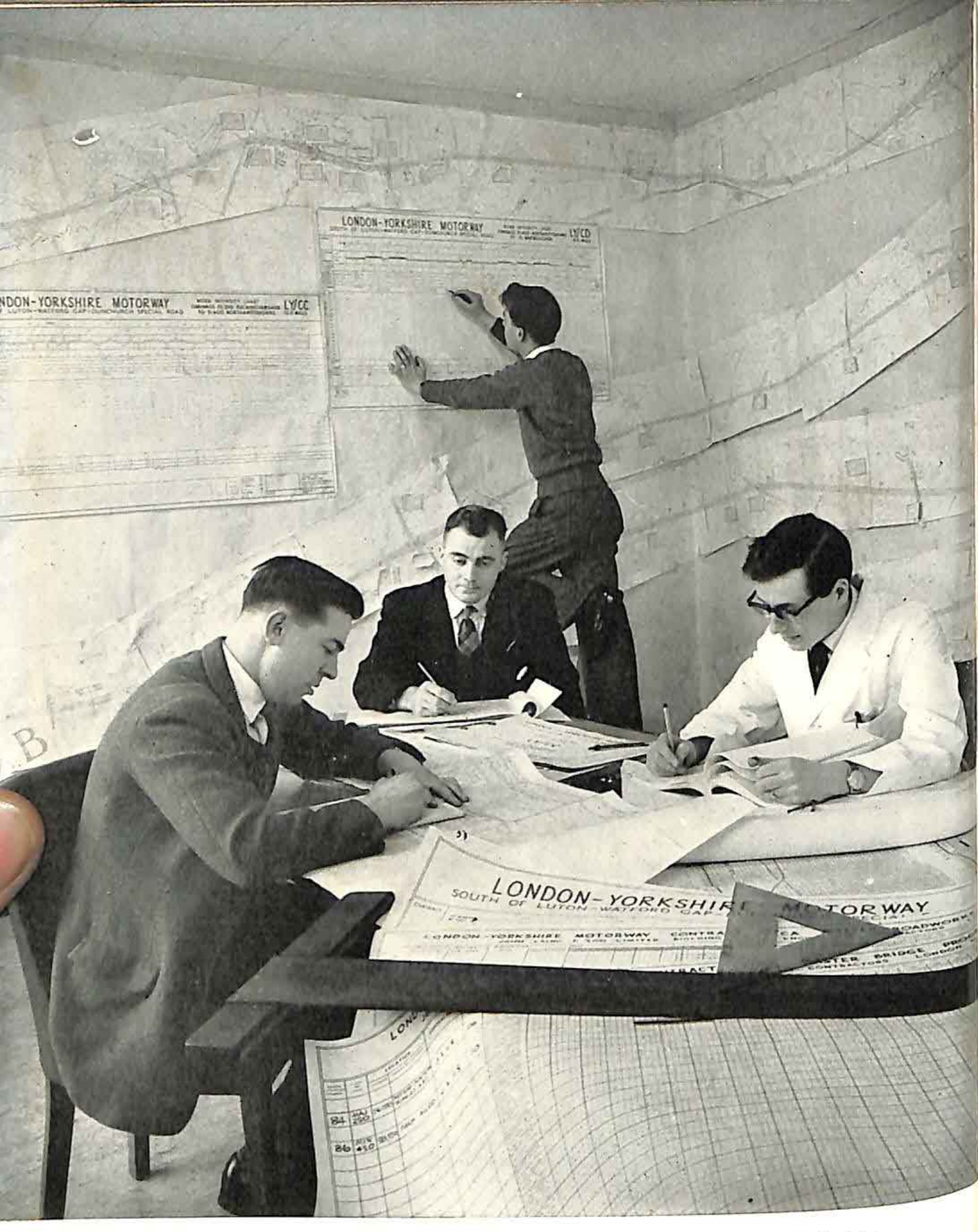
For the boy leaving school between the ages of 16 and 17 who has taken the G.C.E. at " O " level and has attained passes in a satisfactory range of subjects, including mathematics and at least one of the physical sciences, the usual training is under a " technical apprenticeship ". Wide practical experience is combined with part-time studies at an approved technical college with a view to the attainment of a recognized qualification in engineering (such as the Higher National Certificate).

The industry is becoming increasingly aware of the need to recruit university men with degrees in naval architecture, engineering or applied science who wish to follow a career in shipbuilding or marine engineering. Opportunities are therefore available to the graduate with a good degree to obtain two or more years' wide practical training in all the appropriate branches. The graduate with a degree in naval architecture gains experience during his training in the ship drawing and design offices, in the mould loft, in production planning, in the construction departments, and at the building berths. The engineering graduate specializes in general on the engineering side, and training programmes are devised to enable him to acquire practical knowledge of engine design and development, and of steam and gas turbine and diesel construction.

Since the administrative and commercial side of shipbuilding,



14. An apprentice learns how to operate a hydroptic jig borer at Joseph Lucas Ltd., Birmingham


LONDON-YORKSHIRE MOTORWAY
LY/CD
LONDON-YORKSHIRE MOTORWAY
LY/CC
LONDON-YORKSHIRE MOTORWAY
SOUTH OF LUTON-WATFORD GAP

15. Details of the construction programme for the London-Yorkshire Motorway being discussed in the planning office at John Laing and Son Ltd., Mill Hill

ship repairing and marine engine-building is of no less importance than manufacture and design, its need for trained men of the necessary calibre is just as great. Careers are therefore open to young men whose interests are in commerical work to serve a five years' commercial apprenticeship, in the course of which they gain practical knowledge of all branches of the work.

The commercial apprentice is encouraged to pursue his studies at evening classes and under day-release schemes in order to obtain the qualifications of the professional institutes, such as the Chartered Institute of Secretaries, the Institute of Cost and Works Accountants, or the Association of Certified and Corporate Accountants. Those who qualify in this way may look forward to a satisfying and remunerative career, leading in some instances to the post of company secretary or commercial director.

19

A CAREER IN THE RAILWAYS

BY

Sir Landale Train

MEMBER OF THE BRITISH TRANSPORT COMMISSION

The programme for the modernization and re-equipment of British Railways has opened up a big sphere of opportunity for young men seeking a career in a vigorous and competitive undertaking. The impact of this programme, for which a vast mass of new equipment is already beginning to appear, is such that in every railway department men are needed who can match its demands, for it is recognized that equipment alone cannot transform the railway service. The right men must lead the staff who work it and men of ideas must be constantly reviewing new techniques and the changing pattern of transport needs.

The railways in this country were one of the first large industrial undertakings to appreciate the need for the careful selection and training of staff for management. Training is mainly undertaken by means of a group of special schemes, such as traffic apprenticeships, engineering graduateships, and studentships. Each scheme is related to an important branch of railway activity and is followed by an essential period in which men are trained and tested in practical jobs at different levels. For men who show definite qualities of leadership during training, every type of railway post is open, subject only to the professional posts being filled by professionally qualified men.

The main activities of the railways include the traffic department, concerned with the running of trains and with procuring and developing traffic, accountancy and the various engineering branches. Each of these main branches has a special training scheme, linked where necessary with the relevant professional institutions. Whatever the activity, however, the qualities required by management are much the same. The essential thing is that trainees should be anxious to take a full measure of responsibility as quickly as possible.

The changing pattern produced by the mounting programme of modernization affects equally all the branches of the industry. Inevitably, however, the first effects of a programme so much concerned with technical re-equipment is being felt in the technical departments.

Entry and further training

British Railways already have one of the largest engineering organizations in the world, and the wide and varied field of experience that they offer to young engineers training to qualify for professional status has long been acknowledged by the engineering profession. The work of railway civil engineers, for instance, deals with practically every aspect of civil engineering, and covers a range far wider than in any other industry. All the other branches of engineering, mechanical and electrical, are included. The need for competent staff in the technical departments is met by training schemes for recruits at all levels. Candidates may join from schools as craft apprentices or student trainees, or from the universities as graduate trainees.

Craft apprenticeships in civil, mechanical and electrical engineering, and probationerships in signal engineering are open to boys leaving school between the ages of 15 and 16. The boys are trained in railway workshops and in special apprentices' training schools at various centres such as Crewe and Derby, and are encouraged to attend evening classes at technical schools. Those who show exceptional ability may be considered for admission to one of the higher training schemes.

Suitable boys from 16 to 18 years of age with an educational background equivalent to the General Certificate of Education, " O " level, are accepted as student engineers and engineering apprentices. They are given a five years' course which provides a thorough grounding in modern engineering practice. Successful candidates who gain professional qualifications are, after a further 12 months' experience in the drawing offices, appointed to the professional, technical or workshop supervisory staff according to their suitability. Those who show exceptional promise may be considered for admission to an appropriate graduate training scheme.

For boys of 18 years of age who have gained the General Certificate of Education, " A " level, with passes in mathematics and at least one science subject, there are special sandwich courses in civil, mechanical and electrical engineering. These schemes consist of five-year courses in which the students spend six months of each year in the railway industry and six months at a university or technical college.

Graduate courses in all branches of railway engineering are open to young men from the university with an engineering degree who have passed, or gained exemption from, the first two parts of the final examination for associate membership of the professional institution concerned. They are given two years' training in the railway industry, and if successful proceed immediately into the planning and direction field of railway engineering. In whatever capacity he is enrolled, the new entrant undergoes a thorough training in as wide a range of engineering as possible, and is given every facility to continue his studies.

For boys who are not of an engineering turn of mind there are clerical posts in all departments which can lead to the highest administrative positions. A good standard of education is sought from candidates who wish to enter the clerical grades of British Railways, and all must pass an entrance examination unless they hold a General Certificate of Education with passes in suitable subjects. The work of a railway clerk differs vastly in character, scope and variety from the usual conception of a clerical occupation. In the traffic department, for instance, it includes the compilation of timetables and railway charges schemes.

Young men of real promise are accepted for three years' special training as traffic or accountancy apprentices. These schemes may lead to managerial positions in operating, commercial and accountancy spheres, and are open to both university graduates and members of the staff up to 28 years of age, the latter being selected by competitive examination.

Promotion

The common factor to all the British Railways training schemes, both technical and traffic, is that no matter on what level a new recruit enters the railway service, a promising opening awaits him. For those who show special aptitude, facilities are provided for attending more advanced technical or management courses at colleges or universities.

Once a man has completed his basic training in any of the managerial schemes, either technical or non-technical, he is usually appointed to a practical job carrying an annual salary of £700-£750 (or more in the technical departments)—for example, in the traffic department as a goods agent or an assistant in a large marshalling yard; and in engineering as a technical assistant in a main works or at headquarters. This is probably the most critical period of his career, for it is his first taste of responsibility and his capabilities are now tested to the full. His progress is carefully watched and if he does well he can be practically certain of rising to a position with a salary of about £2,000 a year. For men with exceptional abilities there are exceptional opportunities.

A railway career can be an outstandingly interesting one. You can work indoors or outdoors, in posts all over Britain, and, however you start, as an engineering, traffic, or accountancy apprentice or in any other capacity, promotion to the top is governed only by ability and enthusiasm. It is a permanent, pensionable job, with paid holidays, and carries with it certain favourable travelling facilities. The plan to modernize British Railways is a programme of new ideas requiring a new attitude of mind. Young, able, and ambitious men who can meet the challenge will find in British Railways a satisfying career.

20

PROSPECTS IN THE MOTOR INDUSTRY

BY

J. Wilson

DIRECTOR OF EDUCATION AND TRAINING,
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The motor industry offers exceptional opportunities to young men starting their careers. It is young, enterprising, and progressive, and is expanding at home and oversea. These are features that go to make it an attractive choice for those with initiative, resourcefulness, and creative ability. In its fullest sense it includes large manufacturing companies, some smaller firms also engaged in manufacturing, and a large number of firms producing components. The large companies have also established manufacturing or assembly plants in countries abroad. The major products are motor cars, commercial vehicles, marine and industrial engines, and tractors.

The growth of the industry during the past 20 years has been one of the outstanding features of British industrial history. In 1957 it accounted for about 6 per cent. of the country's total industrial output and over 12 per cent. of total United Kingdom exports. Both these figures are still rising, and this country heads the list of the world's motor vehicle exporting countries. No more convincing evidence of its substantial contribution to the national economy can be given than that the average annual value of exports for each person employed in it is between £800 and £900, which is three to four times the average for British industry as a whole. Confidence and optimism are revealed in the vast plans for expansion, estimated to be costing over £200m., now being carried out by the large manufacturing companies. An expansion programme of that magnitude is based on knowledge of the worldwide trend towards " motorization " and of the competitive challenge from abroad. Vast stretches of the earth's surface have yet to be traversed by roads and by road vehicles. World population is increasing by 43 millions yearly and thereby multiplying the number of potential users of private and commercial vehicles. Industrialization of hitherto under-developed countries is further increasing the demand for motor transport.

Other producing countries—the United States, Germany, France, Italy, Canada, Sweden, Russia and Czechoslovakia—are also seeking outlets for their motor vehicles. British manufacturers meeting this challenge by achieving quality and quantity production at the lowest possible cost must necessarily be highly efficient. Therefore the most modern techniques must be used in the planning and equipping of factories.

Accordingly, the motor industry has become one of the most technically advanced in the country; indeed, it can rightly claim to be one of the pioneers of automatic production and automatic control of production processes. The modern factory abounds in examples of both: multiple-head transfer machines; automatically directed and controlled conveyor systems; and automatic control of operations covering machining, pressing, stamping, painting and drying of bodies. Other controls also help to maintain high quality standards. A great deal remains to be achieved by the means at our disposal, particularly in the field of control, which may be operated through mechanical or electrical, electronic, magnetic tape, pneumatic, photo-electric, hydraulic, caloric or sonoric devices. The era that lies ahead opens up new horizons for the development of nuclear devices.

Variety—market research to engineering

This complexity and range of plant with automatic machines, conveyors and control devices, working to a finely gauged time cycle for continuous and speedy production, has added to the importance of operational efficiency and maintenance. A new conception of the role of those responsible for plant installation and maintenance has thus emerged.

The motor industry has to contend with an unusually large number of factors influencing the saleability of its products;

among these are price, appearance, performance, durability, suitability for the special conditions prevailing in oversea markets and, not least, after-sales service. To meet these requirements, therefore, efficient production must be supported by extensive market research, and by technical research and development on new products, new materials, new processes and new ideas. All this must be reinforced by high quality design in its many aspects—body, engine, transmissions, suspensions, and jigs and tools—and attention to high standards of inspection, planning, buying and costing.

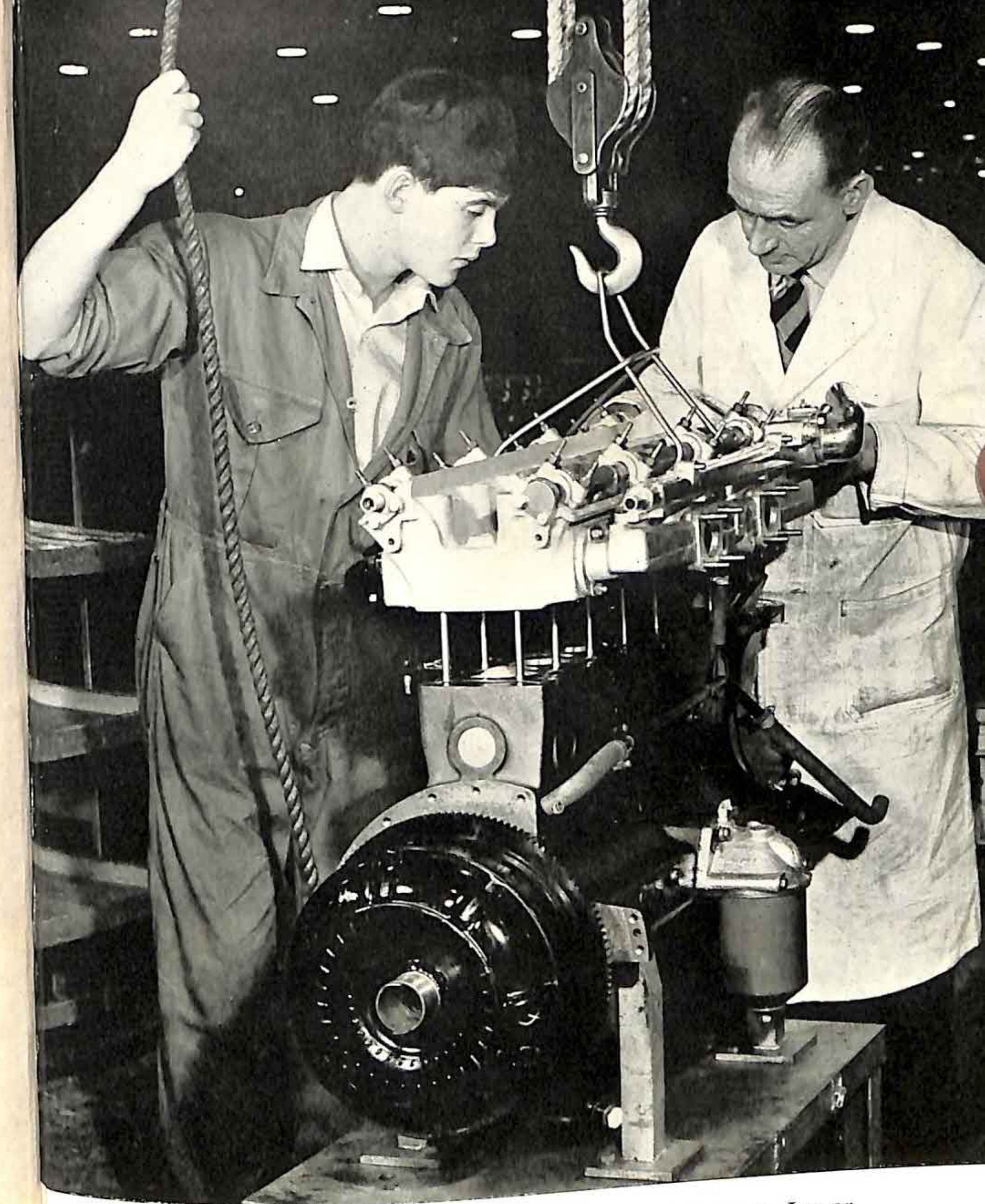
Each of the large manufacturing companies sells its products at home and abroad through a widespread network of distributors and dealers who form the vital link between producer and consumer. It is the responsibility of the manufacturers' home and export sales staff to maintain close and personal contact with their distributors throughout the world. A comparable organization exists to deal with after-sales service in the zoned territories at home and oversea.

The financial and commercial aspects of this highly competitive industry, which has such wide ramifications and is involved in vast capital development programmes at home and abroad, indicate the great scope it offers for careers. Indeed, its achievements are symptomatic of cooperation and team-work between accountants, commercial staff, research workers, designers, engineers and sales and service staff. Hence the training and education of the staff who satisfy its general and special requirements are a major operation as important to the future as the expansion of material resources.

Entry and further study

In the fields especially of research, development, design, production, planning and plant engineering, abundant opportunities are opening up for an ever-increasing number of engineers, who, by their technical and practical training, may become experts in specialized functions. Young engineers with suitable personal qualities will also find opportunities in the sales and service departments at home and abroad, particularly when markets are expanding. Metallurgists, applied physicists and electronic engineers, in limited numbers, can be placed in research and development departments.

A career on the commercial staff will lead to professional



16. An apprentice working on engine assembly lowers a Jaguar cylinder head into position under the watchful eye of his instructor

17. Apprentices being shown how to install a fire warning light on a de Havilland Comet.

18. Apprentices at the British Railways School at Crewe with the locomotives they will eventually build and repair

appointments for those who qualify in secretarial work or industrial cost-accountancy, and may be extended into the spheres of sales, service or buying.

The large companies have accepted in an enlightened manner their responsibilities for training and education and have comprehensive schemes from apprenticeship to management level. The types of apprenticeship normally offered are craft, engineering or technical or student, commercial and post-graduate. Recruitment for craft apprenticeships is between the ages of 15 and 16, for engineering and commercial between 16 and 19, and for post-graduate at a higher age. Boys who enter the industry at 15 are catered for through a pre-apprenticeship scheme. While normally craft apprentices do not require to hold a General Certificate of Education, some trades need boys with a basic knowledge of mathematics and science, because of the changing nature of skills in highly mechanized and automatically controlled plant. For technical and commercial apprenticeships the G.C.E. in five subjects, including mathematics, physics and English at " O " level, is essential; and boys who have taken the first two of these subjects at " A " level are considered for sandwich training.

Apprenticeship is planned to meet the fundamental practical and educational requirements for subsequent careers. For engineering apprentices it takes the form of basic training in a works training school for a period of one year or more, followed by a broad general training in practical work selected from a wide variety of manufacturing, assembly, drawing office and experimental operations appropriate to the type of apprenticeship. It is customary to place an apprentice during the last six months of his term in the department where he will make his career initially. The training committee or committees interview apprentices a year before completion of apprenticeship, and when it is ended establish the personal interest and obtain the first-hand knowledge that help to direct the young men along the right lines.

The educational aspects of apprenticeship are planned to relate courses of study at the technical college to types of apprenticeship, and to the intellectual ability of the apprentice. Transfers from one grade or course to another wherever possible ensure both recognition of meritorious performance and also adjustment to standards that can be achieved.

Craft apprentices aim to obtain certificates of the City and

Guilds of London Institute, and engineering apprentices the Higher National Certificate with endorsements in an additional engineering subject and in industrial administration. Metallurgical, applied physics, and commercial apprentices also aim to obtain the Higher National Certificate in their particular subject. Apprentices, other than craft apprentices, are encouraged to secure graduate membership of the appropriate professional institution. They are granted day-release to attend the technical or commercial college. Those selected for the sandwich scheme are released for six months each year to follow a course of studies leading either to the Diploma in Technology (mainly in engineering, but for a small number in metallurgy and applied physics) or to a professional qualification in cost accounting or secretarial work for commercial sandwich apprentices. Graduates recruited direct from the universities may obtain two years' practical training under the graduate apprenticeship scheme. The large companies make provision for scholarships to enable outstanding apprentices to take a full-time university degree, and selection normally takes place after the second or third year of apprenticeship.

The policy of " promotion from within " is widely accepted in the industry, and for that reason particular attention has to be given in the training schemes to developing existing talent to the full. Indicative of this is the " three-route entry " into the sandwich apprenticeship scheme. In this system boys may be selected direct from secondary, grammar and public schools, provided they have passed the appropriate G.C.E. " A " level subjects, or after completion of the S2 year of the National Certificate course, or after passing the Ordinary National Certificate. (In the first two cases high standards have to be achieved.) The existing schemes embrace a diversity of interests ranging over the various branches of engineering, commerce, metallurgy, technical sales, and service.

The training and education given during apprenticeship are only the first stage in preparation for a career. In the large companies they are implemented by the facilities provided for recreational, sporting and social activities and for taking part in conferences, visits and residential courses. Valuable experience is gained in organization and administration through these activities. After apprenticeship, further development depends largely on the individual himself. He will find that administrative ability, leadership and a keen sense of costs are among the essential attributes in reaching the higher executive posts. Some companies provide post-apprenticeship training in administration for selected candidates, offer facilities for continued day-release to take administration courses at a technical college, or make use of external or internal residential courses. At a later stage opportunities to attend executive development courses, functional management and general management courses are also provided.

The motor industry is facing the future with confidence and vigour, prepared to meet the competitive challenge from abroad and determined to capture its share of the developing markets oversea. To do so it will rely, in the long term, on the quality and calibre of the young people it recruits now.

21

NEW TECHNIQUES FOR AIRCRAFT

BY

H. W. Goodinge

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If this country is to meet the challenge in the air of its foreign competitors, its essential needs are greater than anything we have known in the past. New fields of scientific knowledge have to be drawn on, and more and more men and equipment will be required to apply that knowledge in our research and design departments and factories. We shall have to pay continuous attention to manufacturing methods, increased efficiency, and the application of new techniques of production. In business management we need to develop improved relationships between all those engaged in the common enterprise to avoid the wasteful industrial conflicts that have handicapped us in the past.

Since the aeroplane of today is highly complicated, its construction requires the practical application of many sciences, not just the results of structural and aerodynamic knowledge; metallurgy, chemistry, electrical, radio, electronic and hydraulic engineering all have a vital contribution to make. This complexity makes the British aircraft industry not simply a number of aircraft and engine-constructing companies, but a vast interlocking organization embracing specialist companies skilled in component and equipment design and manufacture. Besides the fields of conventional civil and military aircraft, there are those of research, development, and the production of guided weapons.

The industry is not concentrated in any one location; it follows the broad national pattern of the spread of light industry. Aircraft and aero-engine manufacturers, as well as concerns specializing in the design and production of equipment, instruments, components and materials, are to be found throughout the country.

Training for a degree or National diploma

Reference is made below to " boys " and " men " as a matter of convenience. All careers in the aeronautical profession are equally open to women. Though engineering is not yet of general appeal to girls, increasing numbers take it up every year.

For the university graduate who has read engineering or applied science a two-year training course is available in most companies. This gives general practical training, followed by specialized instruction in technical departments or laboratories. After this he is qualified for a responsible position in the company, and is assisted in gaining graduate membership of one of the professional institutions. The first year's practical training is generally essential, but where practical experience has already been acquired during vacation training, special arrangements can be made.

Aircraft and aero-engine companies are vitally interested in recruiting the right kind of graduate: the man who is well equipped in his own field of study and can also take his place successfully in an engineering community. There is no secret formula for success; results are achieved by plain hard work, sound thinking and, above all, enthusiasm.

Boys leaving a public or grammar school who wish to combine a practical training within the industry with full-time or part-time attendance at a university leading to a degree, must have obtained the necessary entrance qualifications to a university before they can be accepted as apprentices in the industry. These apprenticeships, known variously as undergraduate, student or engineering, are designed to meet the needs of young men wishing to become professionally qualified.

Entrance qualifications vary with the university chosen, but normally the boy will join the scheme at about 18 after passing the necessary subjects in the General Certificate of Education at " A " level. There are two common schemes of training. In the first, the boy receives one year's training in industry followed by three years at a university, with vacation training in industry and ending with one year's post-graduate training. In the second the boy spends a time in industry, and then joins a four-year sandwich scheme at a university. Both courses take five years, of which nine terms are at the university.

The industrial experience includes a broad training throughout the workshops, usually with an introductory period in a training school and a period of at least a year in laboratories and technical departments appropriate for the particular career desired. So far as possible, the work done and periods spent in the various technical departments are related to the apprentice's studies. This is now considered to give the best training to the apprentice who wishes to become professionally qualified.

Sandwich courses

All the large aeroplane and aero-engine companies, as well as some of the material suppliers and accessory manufacturers, offer sandwich courses in conjunction with a university or engineering college. This system overcomes the old engineering plaint that the university graduate lacked practical workshop experience.

Engineering apprentices are recruited between the ages of 16 and 18 from grammar and technical schools, and are generally required to have passes at " O " level in mathematics, English, a suitable science subject, and one other subject in the General Certificate of Education. The normal training is based on the Ordinary and Higher National Certificates and Diploma course of studies with endorsement subjects to meet the academic requirements of the appropriate professional institutions. The engineering apprenticeship is usually four or five years and ex-apprentices are encouraged to complete any outstanding examinations for which they are studying.

Several methods of securing this academic training are available. Many apprentices qualify through part-time release courses at local technical colleges, leading to the Higher National Certificate and endorsements. Others join a Higher National Diploma sandwich course at a technical college after securing the Ordinary National Certificate. This course allows six-monthly periods of full-time study at a technical college to be sandwiched between similar periods of practical training within industry. When an apprentice takes a sandwich course it is normal to extend the apprenticeship until completion of the course.

Most industrial training begins with a period in an apprentice training workshop. This is then followed by practical work in various departments of the factory. At the age of about 20 when his practical training is complete, the apprentice works for a period in selected technical departments. Before the end of his training he is generally working in the department where he finally expects to become established.

Trade and craft apprenticeships

Finally, there is the group of boys who wish to become trade or craft apprentices, and whose talents incline them towards the many skilled operations essential to the building of our aircraft and aero engines. No matter how excellently the design staff have fulfilled their responsibilities, the highest possible quality of workmanship is always needed in the finished part or components. This is taught by the industry in its trade apprenticeship schemes, designed primarily for boys leaving the secondary modern and technical schools with a good general education. Apprenticeship starts at 16, or on engagement if they start when over 16. When under 16 on joining a company, boys are employed on general work until their sixteenth birthday. The period of apprenticeship is five years (usually with the first six months as a probationary period) so that the boy has the opportunity to become a craftsman by the time he is 21. This enables an alert boy to acquire the knowledge to undertake a skilled job in the factory at the end of his training.

The apprentice may fill any one of a number of skilled jobs. He may become an aircraft-fitter, toolmaker, sheetmetal worker, engine-fitter, electrician, or pattern-maker. He will be given a variety of lectures, and trade apprentices are encouraged to attend technical college during working hours to study for City and Guilds Certificates. A few apprentices may take the National Certificates in Mechanical, Electrical, or Production Engineering, although the City and Guilds courses are more appropriate. The boy who is taking an Ordinary National Certificate course is usually elevated to the engineer apprentice grade during this period.

Throughout all the courses the apprentice receives wages appropriate to his age, and no deductions from wages are made for absence while attending an approved course at a college or on authorized works visits. No premiums are required for any grade of apprenticeship.

The question of National Service may have affected young men considering an apprenticeship training, although this is no longer a general problem. The university student may still have to complete his national service after apprenticeship; but it means that his period of national service will normally be done on appropriate work, for his training will be considered by the selection board.

22

VARIETY IN TEXTILES

BY

P. A. Holt

When looking at the textile industry from the point of view of young men and women seeking a career, it is convenient to treat the cotton and the man-made fibre industries as one. Man-made fibres, which are produced by processes mainly chemical, have no manufacturing industry of their own, but they provide an important range of raw materials for the spindles and looms of Lancashire and elsewhere. Thus, anyone entering what is broadly called the cotton industry may be expected to be just as much at home with, say, rayon or nylon or the other synthetic fibres as with cotton. About one-quarter of the cloth produced in Lancashire is, in fact, made wholly or partly of man-made fibres. It is a most fascinating industry, catering for the constantly changing requirements of the world of fashion and the more utilitarian demands of the home, of industry, and of the public services.

In recent years many of Britain's bright young men have been attracted by the new and exciting industries that have sprung up since the war. As a result, the textile industry has not had its share of young men to train as scientists and technologists. But for this very reason the demand is now such that the outlook for youth seems particularly promising. The prospects are further improved by changes that are rapidly taking place in the organization of the industry. Many of the smaller firms are either disappearing or being taken over by the giant organizations with their well-developed schemes for training and promotion. Large corporations, particularly in spinning, have not only been growing larger by absorbing more units but have in various instances extended their activities to embrace other sections of the industry, which is still predominantly horizontal in structure. Such concentrations offer advantages because they make possible the more efficient use of expensive modern equipment and the economies consequent on specialization. Thus, though in future the industry may consist of fewer firms, its productivity and efficiency will be enhanced.

The textile industry accepts the challenge of competing industries in other parts of the world, and the young man that it is seeking today will find in international competition problems and objectives in textiles quite as absorbing as those in other industries popularly considered to be more glamorous. Technical ability and initiative are more and more in demand, for the advent of synthetic fibres, all of which have different properties, means that the textile industry is on the march and the rewards of enterprise can be great.

Qualifications and entry

Who then are the young men that Lancashire is seeking to help to build up and streamline the modern textile industry, and what qualifications do they require? Briefly they are:

1.—University graduates with degrees in textile technology, science, economics or arts subjects.

2.—Technical college students with qualifications in textiles, science, electronics or engineering.

3.—Public and grammar school leavers with good G.C.E. qualifications at either Ordinary or Advanced level. The Advanced level students might be expected to take university or full-time technical college courses and those with Ordinary level qualifications might enter the industry as trainees taking the technical college courses on a part-time day basis.

4.—The industry also has an urgent need for more boys from the " A " streams of the secondary modern schools capable of taking the practical craft courses now available at the technical colleges and thus qualifying for supervisory posts.

It will thus be appreciated that there are opportunities for young men to enter the industry after having completed a full-time university course and, equally, opportunities for boys leaving school to join a firm, when they will receive training, part-time practical and part-time educational, leading to a recognized qualification.

There are a great many university entrance and technical college scholarships now available to young people who intend to make the textile industry their career. Most of the large firms have well-developed training schemes and do everything they can to encourage their young people to take advantage of the educational facilities provided. In addition to the degrees and diplomas granted by the education authorities, textile students are encouraged to study for the Associateship of the Textile Institute (A.T.I.)—the professional qualification of a chartered textile technologist, recognized throughout the textile industries of the world. There are also more specialized qualifications, equally widely recognized, controlled by the Society of Dyers and Colourists and others controlled by the City and Guilds of London Institute.

Scope of work in the industry

The industry is so complex and covers such a wide range of activities that here it is only possible to indicate the main fields in which its highly trained personnel may be expected to find a place. They are:

Research and Development
Management and Productivity
Plant and Maintenance
Cloth Production and Design
Sales and Promotion
Market Research

There is plenty of scope for the trained chemist and physicist, particularly in the fibre production section of the man-made fibres industry and on the production and development sides of the dyeing, printing and finishing sections. The two main research associations, the British Cotton Industry Research Association and the British Rayon Research Association, both have an international reputation and between them employ a large number of graduate scientists. Much important work is also done in the research laboratories of large firms in the spinning, manufacturing and finishing sections. Here it is not inopportune to recall that one of the major British fibres—Terylene polyester fibre—was discovered in the Lancashire research laboratory of a leading textile printing firm.

While some young men have a leaning towards research, others prefer to be associated with the application and development of research on the mill floor. In the second class the industry includes men who have studied textile technology at the universities or technical colleges and taken their degree, diploma or their A.T.I. examinations. Others are chemists, physicists or engineers who have found it useful to obtain qualifications in textile processing.

Spinning, weaving and finishing machinery is now complicated in design, and there is plenty of scope for the technologist with special skills in engineering. Automation, electronic control, high temperature processing and other modern techniques now applied to textiles all increase the demand for highly trained specialists. Chemical engineers are also much sought after by the man-made fibres producers, and they will also find opportunities in the dyeing and finishing sections. Specialist engineering graduates of many types have a place in the works of the textile machinery makers.

A key position in the industry is now held by the man employed on the merchanting side, whose job is to forecast consumer demand and select the range of cloths and designs to be marketed each season. He must combine a first-class knowledge of textile technology with a highly developed aesthetic sense and have the experience to assess fashion trends in terms of design and cloth construction. He is considerably influenced today by the findings of those engaged in market research, who are able to provide information about the effects of style trends and fashion changes. In both sales and market research there are opportunities for those who can speak foreign languages, and who possess the enthusiasm and energy called for by the modern techniques of selling. For such men there are available special courses that provide them with a sufficient knowledge of textile technology, testing, and processing techniques.

Those who wish to take up a career in textiles will find that the industry is particularly well endowed with practical educational facilities. Full-time courses in textiles are available in the universities of Manchester and Leeds and in the technical colleges in Bolton, Blackburn, Bradford, Burnley, Glasgow, and Salford. In addition, well-equipped technical colleges are to be found in all the larger Lancashire towns, where the training is particularly appropriate for the young man who has started on the first rung of the ladder as a trainee with some firm in the industry.

Finally, for those who are already members of the industry and who aspire to higher levels of management, or perhaps wish to bring their knowledge up to date, the Cotton Board Productivity Centre at West Didsbury runs courses in work study, quality control, cost control, specialist operative training and foremanship.

Apart from these technical, production, and sales sides of the industry, it should not be forgotten that the textile industries were pioneers in the formation of large mergers, and there are great opportunities for young men to take up careers on the administration side of the industry.

For detailed particulars of textile education application should be made to the Cotton Board, Royal Exchange, Manchester 2, The British Man-Made Fibres Federation, 58, Whitworth Street, Manchester 1, or the Textile Institute, 10, Blackfriars Street, Manchester 3.

23

POSSIBILITIES IN PLASTICS

BY

J. N. Ratcliffe

SECRETARY TO THE COUNCIL OF THE PLASTICS INSTITUTE

To most people plastics are a new industry, for it was not until after the Second World War that their products began to make an impact on the general public. But the foundations of what we now term plastics go back to 1865, when Alexander Parkes in Birmingham used nitro-cellulose in the production of a synthetic ivory. " Parkesine " was the forerunner of " xylonite " and is identical with " celluloid ", the American article which in the 1870's was the first commercially satisfactory plastics product. Parkes described his achievement by saying: " I have produced a substance partaking in a large degree of the properties of ivory, tortoiseshell, horn, hard wood, india-rubber, gutta-percha, etc., which I believe to a considerable extent to be workable in the same way as metals and wood."

Development was at first slow, and the next major stage was not reached until the early years of this century, when Baekeland carried out pioneer experiments on the condensation of phenol and formaldehyde. The idea of using the fully synthetic products of chemical reactions in a number of industrial applications was new and revolutionary, and these, together with the semi-synthetics of the previous era, such as gutta-percha, celluloid, cellulose acetate and casein, formed a new class of materials which were called plastics.

In 50 years plastics have gone a long way, but the most marked advances in scientific and technological progress have been concentrated into the past 25 years. These years have seen the completion of Carothers's study in America of chemical synthesis, which showed that the large-molecular structures characteristic of plastics could be built up to a pre-determined pattern. Nylon, now being used more and more widely in industry and the home, was the product of this study. Other developments include the modification and improvement of the physical properties of built-to-order molecular structures by irradiation, and a great deal of work in connection with the discovery that unsaturated simple hydrocarbons (for which the raw materials are exceptionally cheap, since they are derived from petroleum) can be polymerized at low temperatures and pressures. These latter processes are relatively simple and the possibilities for the future are enormous.

Plastics are now one of our basic industries. In 1957 nearly 400,000 tons of raw materials (30,000 in 1939) were produced in the United Kingdom—as much as the combined total output of copper and the consumption of rubber. Exports alone are valued at £30m. and are steadily increasing. The industry is of enormous importance, not merely to itself but to practically every other industry as well.

The electricity industry is one of the biggest users of plastics, because of their efficiency in insulation. Other important industries making more and more use of what to some of them is still a comparatively new material are those concerned with mechanical and chemical engineering, aircraft, automobiles, shipbuilding, building construction, refrigeration, printing and packaging.

Plastics are chemicals handled by engineers and, being materials of construction, it is likely that a great deal of their success in the future will be measured by the progress made in combining them with conventional materials. An example of this is the recent production of a sheet of steel covered on one side with a thick coating of plastic. The sheet can be bent and shaped, seamed, crimped, and welded, without affecting the plastic. Thus the appearance and anti-corrosion qualities of plastics have combined with a traditional material to make a better final product.

Opportunities and qualifications

It is thus clear that the future will be exciting, and that there will be a demand for a wide variety of trained staff—plastics technologists, chemists, physicists, engineers, technical salesmen, draughtsmen, designers and laboratory assistants. These will find a challenging vocation with:

(a) The plastics material manufacturers—a specialized branch of the chemical industry, the branch that in Great Britain discovered polyethylene;

(b) The moulders—who produce finished articles such as water cans and refrigerator liners from plastics materials;

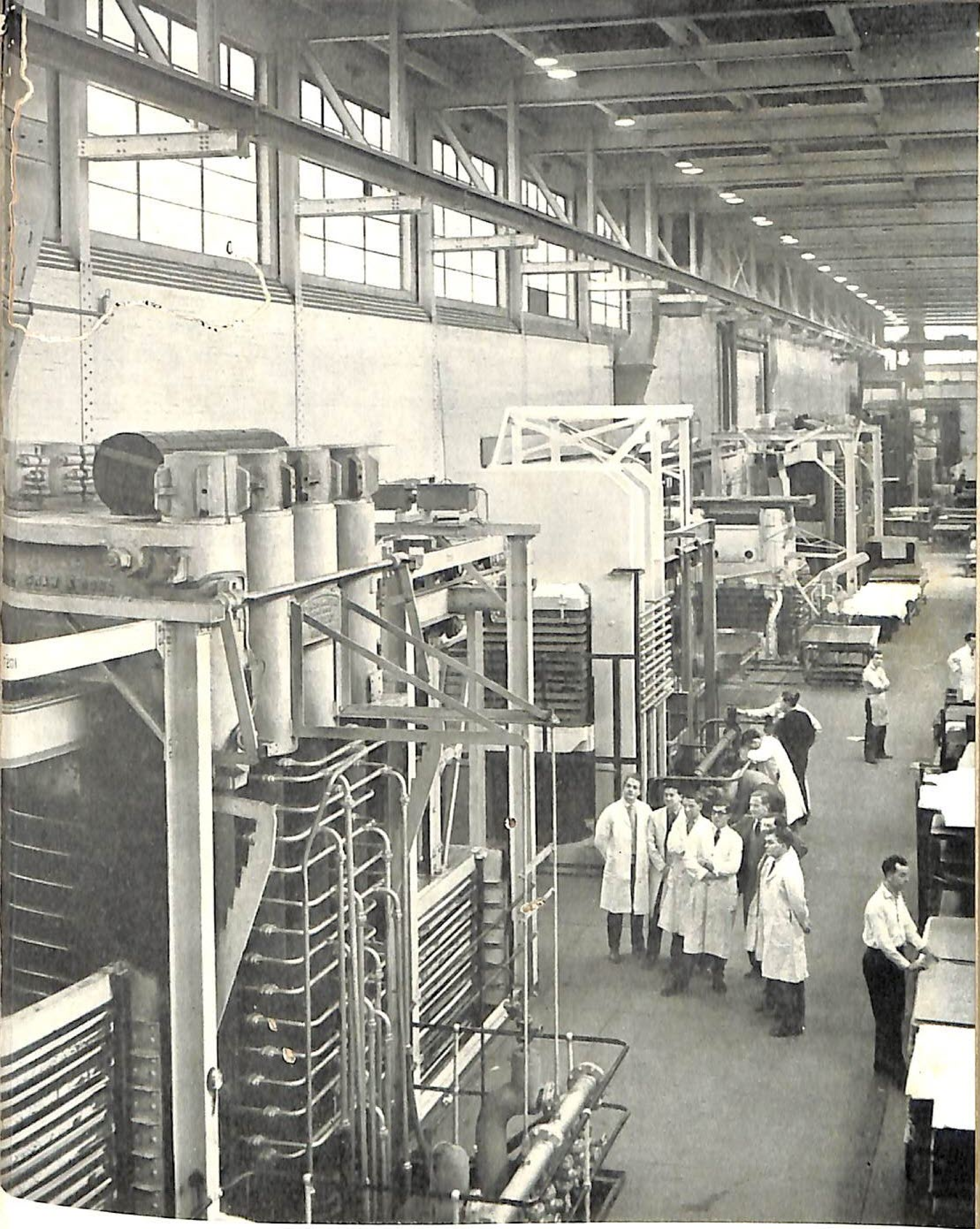
(c) The laminators—who apply plastics materials to paper and fabrics, or who marry them with glass fibres and produce various shapes and forms such as yachts and motor car bodies; or

(d) The plant manufacturers—who embrace the chemical engineering firms making machinery and equipment for the manufacturers of raw materials, the mould and tool makers, and the mechanical engineering firms making machines for pelleting, moulding, &c.

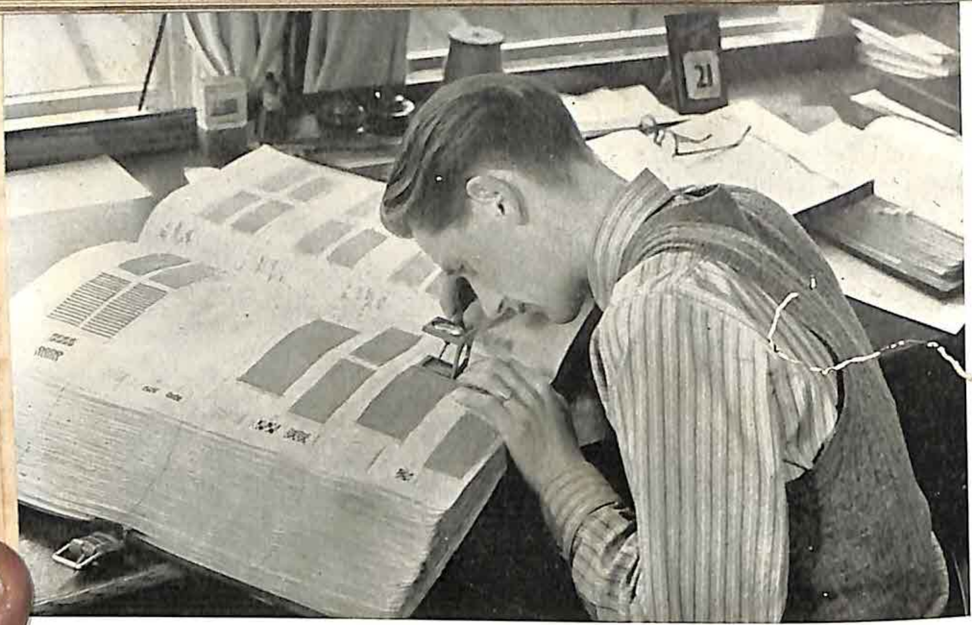
A minimum requirement for any boy or girl wishing to make a worthwhile career in the industry is a good educational standard (G.C.E. " O " level or its equivalent in chemistry, physics, mathematics and English). There are then three principal routes to advancement:

(i) By obtaining employment as a pupil apprentice under the Plastics Institute Scheme recently introduced, or in a junior capacity either in the office, works or laboratory. For such entants there are facilities in London, Birmingham, Manchester, Cardiff and Glasgow for part-time study leading to the City and Guilds of London Institute Certificates in Technology of Plastics, or the Diploma of the Plastics Institute, and in these and other areas for the Ordinary National Certificates in chemistry or engineering. Those able to continue their studies may go on to take a Higher National Certificate and perhaps eventually the graduateship of the Plastics Institute. Training facilities in the industry vary according to the size of the firms. In the large plants training schemes are good, but some of the small units in the moulding and laminating side of the industry are unable to provide facilities for training or part-time study.

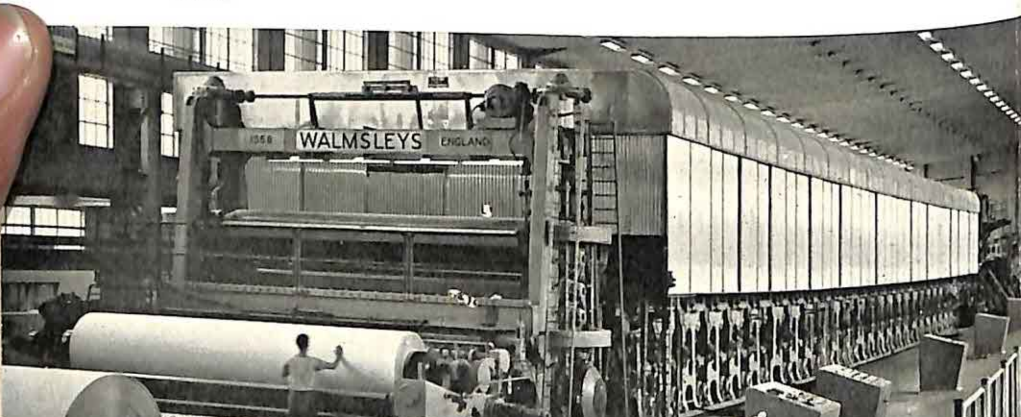
(ii) By entering a technical college immediately on leaving school to undertake full-time study for the Diploma and graduateship of the Plastic Institute, or the equivalent qualification of



19. Production trainees watching the closing of one of the giant presses at the Tynemouth factory of Formica Ltd.



20. A young textile designer examining the construction of a piece of cloth



21. A machine in the Reed Paper Group's mills at Aylesford which produces mechanical printings and newsprint at speeds up to 2,000 f.p.m. The paper emerging from it has just passed through the drying section under the gleaming aluminium hood

other allied institutes, for example, the Royal Institute of Chemistry. Three four-year sandwich courses in applied chemistry or chemical technology with specialization in plastics are now operating for the new national award, the Diploma in Technology.

(iii) By taking a university degree, usually in chemistry, and subsequently taking a full or part-time course in plastics technology.

The Plastics Industry Education Fund provides bursaries for full-time study for students wishing to enter a technical college immediately on leaving school, and also training grants and scholarships for boys and girls in the industry who later desire to continue their technical education at a college or university. The fund has spent during the past two years nearly £15,000 on items such as these concerned with education.

In days of rapidly changing values it is difficult to give an accurate indication of salaries for prospective recruits to the industry, but at least one leading firm is prepared to offer a graduate aged 23 with a good degree a starting salary of £700, and with the continuing shortage of graduates this standard should be at least maintained.

The prospects for plastics are bright, provided the industry continues to raise the quality of its raw materials, to improve the standard of design in its products, and to avoid the misapplication of plastics materials in jobs for which they are unsuited. A good supply of properly qualified technologists, scientists, and engineers will ensure that these requirements are met.

24

DIVERSITY IN THE PAPER TRADE

BY

H. A. Pawson

Papermaking is one of the basic industries of the country. Its products are a part of our everyday lives and as varied as they are useful. There are papers for magazines, newspapers and books; papers for printing and writing; drawing papers, wallpapers, blotting, tissues, toilet papers; and a wide range of papers for technical purposes. There are wrapping papers and paperboards for packaging, which not only provide protection for goods but also present them attractively. There is the growing industrial use of paper and fibreboard, as with wallboard in the building industry or insulation in the electrical industry. These examples give some indication of the diversity of an industry whose continual growth is due as much to the development of new products as to increasing demand for traditional ones.

Papermaking was a craft introduced to this country in the late fifteenth century. It has grown so rapidly, particularly during the past 50 years, that today it is a great modern industry using specialized machinery and the latest techniques. Some idea of its scale can be gauged from the paper machines themselves which, though varying in length, complexity and speed according to the type of paper produced, range up to giant machines 300ft. long making paper in reels 25ft. wide at a speed of over 2,000ft. a minute.

Papermills, like paper machines, vary greatly in size, from a small family business to the large mill producing more than a quarter of a million tons of paper a year. As the process has become more complex, so the range of work has increased with the skill of the craftsman now augmented by scientific control, research, testing and the use of the latest developments in physics, chemistry and engineering. There is, therefore, a considerable choice of opportunity in the 200 and more mills in Great Britain, each of which contains a wide variety of occupations.

Qualifications at entry and further training

One of the larger mills will illustrate the range of careers that the industry has to offer, but the small mill may provide equally attractive opportunities.

On the production side there are openings for trainees or apprentices from secondary modern, grammar or public schools, who are given instruction in all parts of the process before specializing on the machine or on the preparation or finishing operations. Every encouragement and facility is given to them to take the City and Guilds of London Institute examination in paper technology, which is regarded as of great importance by the industry. The necessary instruction is given in the works school and in courses organized by local technical colleges as well as by practical experience on the job. Apart from the Intermediate, Final and Full Technological Certificates, there is an Insignia Award of the Institute for those achieving special distinction. Success in these examinations is a useful grounding for those aiming at production management.

On the technical side, scientific work is in the main closely linked to the processes. In addition to testing and analysis of raw materials and paper there is investigation into manufacturing methods and finished products, and quality and process control work. There is also a considerable research and development programme undertaken by the individual company and by the industry as a whole.

Young entrants should normally have gained " O " level passes in G.C.E. in five subjects, including mathematics and one, or preferably two, science subjects. Practical training is given in analytical laboratories, chemical engineering departments, physical research or mill control laboratories, with encouragement to study through part-time day courses at technical colleges for the Ordinary and Higher National Certificates in Chemistry or Applied Physics.

There are particularly good openings in scientific control or research work for graduates in physics, chemical engineering, or chemistry. While they usually begin and may continue to specialize in this type of work, there is often opportunity for them to enter or transfer later to the operational and production management field.

Research design and sales

Though the science graduate has no difficulty in gaining the necessary paper-making experience, there is one degree course with a special bias towards papermaking. In Manchester the College of Science and Technology has a papermaking section, which is fully equipped with suitable plant for teaching paper technology and research. The college offers full-time day courses leading to the university degrees of B.Sc.Tech., M.Sc.Tech. and Ph.D. In addition, full-time courses in paper technology are being established leading to an Associateship of the College, which will rank between Higher National Certificate and degree standard. In some cases the company may sponsor on these courses a member of its staff with suitable qualifications, while there are also scholarships awarded each year by the industry.

There is always opportunity, too, for engineers. The installation and maintenance of large fast-running machines—which may cost several millions of pounds—and of all the ancillary equipment, including boiler and power plant, calls for a large staff of mechanical and electrical engineers as well as for building operatives.

There is also much design and development work to be undertaken: this demands a high level of initiative and technical knowledge. Engineers straight from the university normally complete their graduate apprenticeship with 18 months' practical training which also gives them an insight into papermaking methods. They have then a wide range of opportunity in engineering and, like the scientists, the chance of transferring later to production management.

For apprentices there is a full practical training and the opportunity of taking City and Guilds of London Institute Examinations or the Ordinary and Higher National Certificates in Mechanical or Electrical Engineering.

There is also a very wide field of opportunity in the other departments, whether in sales or purchasing, accountancy or work study, or in statistics and economic research. For boys who have done well in G.C.E., or for graduates, particularly in mathematics, statistics, or economics, any of these may offer good openings.

In many cases there is also the opportunity of travel, since the paper trade is a world-wide industry. Apart from the company's operational interests abroad, there are close relationships with the suppliers of the raw material, most of which is imported from sources such as North America or Scandinavia. It is common, too, for scientists and technologists to keep abreast of developments in other countries with short visits of investigation.

The exact opening may vary according to the interests of the company, but the small one may well offer just as good prospects as the large. Throughout the industry there are special opportunities for candidates at two levels of education. One is on leaving school after taking the General Certificate of Education, including mathematics and science at "O" level. The other is for graduates, particularly in physics, chemistry, chemical engineering or engineering, for whom there is an ever-increasing number of openings.

Promotion

Papermaking is one of the three industries in this country to have shown the greatest expansion recently, and economists forecast a continuing increase in demand. There is, therefore, likely to be constant development and good prospects for those with initiative and ability. There are, too, a variety of ways to the top and three examples of recent careers illustrate this.

Entry at the age of 15. Elementary education.

Five years as engineering apprentice in mill. National Certificate in Mechanical and Electronic Engineering. City and Guilds Final Certificate in Paper Technology.

Ten years as maintenance craftsman.

Nine years as assistant engineer.

Eight years as chief engineer.

Mill manager at the age of 47.

Entry at the age of 18. High school and technical college education.

Five years apprentice engineering draughtsman.

Eleven years mechanical engineer. Member of the Institute of Mechanical Engineering.
Five years chief mill engineer.
Three years mill manager.
Five years deputy general manager.
General manager at the age of 47.

Entry at the age of 25. University degree in mechanical engineering.
Three years' practical training in mills.
City and Guilds Final Certificate in Paper Technology.
One year as shift foreman.
Two years as assistant mill manager.
Mill manager at the age of 31.

Those interested in the prospects of a career in papermaking can apply for details to their nearest paper or board mill, or alternatively to the British Paper and Board Makers' Association, Melbourne House, Aldwych, London, W.C.2.

25

CRAFTSMEN AND CHEMISTS IN THE GLASSWORKS

BY

Professor R. W. Douglas

Glass-making and working have been practised for thousands of years; the blow-pipe and the craftsman's skill of manipulation still flourish where the finest quality crystal glass is made. But in the past 40 years a complete revolution has taken place in the industry, and nearly all glass manufacture is now dependent on a chain of carefully controlled processes. The glass is melted in tank furnaces that may contain from 100 to 1,000 tons of molten glass. From these furnaces the glass is fed to automatic machines which continuously discharge a stream of formed glass articles. The fastest machine can produce up to 1,000 electric lamp bulbs a minute, while 1lb. jars or one-pint milk bottles are produced at the rate of 50 a minute.

More than 75,000 people are employed in the glass industry. The glass container section is the largest branch, employing nearly half the total. Its 42 factories, which work day and night, produce about 7500 containers every minute. In making flat glass, sheet glass is drawn continuously from the furnace, and polished plate glass is produced by a unique process developed in this country in which glass is rolled, annealed, and ground in a continuous ribbon before being polished. Glass tubing is produced automatically for use in the manufacture of electric lamps and valves and scientific glassware. Domestic glassware, a term that covers many types of glassware in household use such as ovenware, in addition to crystal glass, is produced by automatic as well as by hand methods. Recent developments have brought optical glass, too, into the field of mechanized production, the newest glass works in the United Kingdom being devoted to its continuous production.

Basic and specialized training

The industry is keenly aware of problems of education and training, which are taken care of by the education committee of the Glass Manufacturers' Federation. Methods of training at all grades are continually under review, and every possible encouragement is given to employees to fit themselves for more responsible positions. A multiplicity of skills of all kinds is needed: craftsmen, laboratory assistants, foremen, work study engineers, accountants, engineers, chemists, physicists and glass technologists. Promotion to senior management posts is open to all specialists and technologists who show the ability and personal qualities needed.

Many attractive careers may be based on a good general education and some specialized training as, for example, in accountancy, chemistry and engineering; but here it seems fitting to concentrate on the training schemes and educational facilities peculiar to the glass industry. The Department of Glass Technology at Sheffield University, the only university in the United Kingdom offering degrees in glass technology, was brought into being during the First World War, as a direct result of lack of scientific knowledge about the properties and methods of production of glass. Staunchly supported by the industry during the period of its rapid development after the war, the glass department has not only trained men who occupy leading positions in glass-making, but has also supplied a continuous stream of trained glass technologists and glass scientists, some of whom, preferring the study of glass science, have become leading members of industrial research laboratories. By " glass science " is meant the study of the basic chemical and physcial processes underlying and controlling technological ones.

Glass science cannot possibly be taught without an adequate background of pure science and mathematics. This necessary background is provided by special courses in which, although it is clearly impossible to provide physics and chemistry courses of degree standard, the fundamental science that bears directly on glass structure and properties is rigorously treated, providing the student with the basic knowledge from which he can advance in later years in his chosen sphere. Entry to the Honours degree courses requires three good " A " level passes; but candidates may be admitted to the Ordinary degree course at a slightly lower standard. Subjects of the course include mechanical and electrical engineering, fuel technology, and refractories technology, in addition to glass technology. Glass technology may be roughly divided into two parts, glass science and the production side, which includes studies of fuels and furnaces, glass manufacturing methods, instrumentation and automatic control. It would be possible, perhaps to criticize this course as being too ambitiously broad, but certainly not as being mainly specialized.

The close and happy relationship between the department and industry is reflected in the requirement that students spend a portion of their long vacation in glass works. This " works practice " is of enormous benefit to the student and helps to provide in a sensible and straightforward way that much discussed " wider interest " of which so much has lately been written. Besides seeing at first hand the application of the knowledge he is acquiring, the student can see the application of glass as a material of design and construction and can get some appreciation of the problems of organization and of human relationships common to all industrial enterprises.

The department has a flourishing research school, which is concerned primarily with probing deeper into our understanding of the chemical and physical processes of glass-formation and in understanding the chemical and physical properties of glass in terms of the atoms of which it is made. Students are prepared for the degree of B.Sc.Tech., and in addition the postgraduate students may work for their M.Sc.Tech. or Ph.D. There is also a one-year course, leading to an Associateship in Glass Technology; candidates for this must have obtained at least a high standard in an appropriate Higher National Certificate examination. Finally, there is a one-year course for a Postgraduate Diploma, which is offered to graduates in chemistry, physics and mechanical engineering. Unfortunately the number of students graduating is nowhere near enough at present, and it will take many years before the department can meet the increasing needs of the industry.

The technical colleges, too, are beginning to play their part in the training of technologists. St. Helen's Technical College and

Northampton College, London, have recently introduced sandwich courses leading to the Higher National Diploma in chemistry where students may specialize in basic glass technology. Entry normally requires two "A" level passes or a good Ordinary National Certificate pass. In addition, Doncaster Technical College has just started a part-time course in basic glass technology. Craftsman's courses for apprentice glass-blowers and decorators are held at the Stourbridge College of Further Education. Edinburgh College of Art has a department devoted to the study of glass as a medium of artistic expression.

Mechanization and automatic control are being increasingly applied in the industry, which, in fact, is awake to modern developments; for example, silicones are now being used for mould lubrication, and their use is making the glass works a much cleaner place in which to work. The training available, the opportunities open and the virility of an industry that has advanced so rapidly in the past few decades offer much to energetic, enthusiastic young people.

26

THE APPEAL OF POTTERY

BY

Sir John Wedgwood

A young man's decision as to the industry in which he would like to take up a career is likely to be influenced by the products manufactured by the industry, its future prospects, whether or not it is progressive, the urgency of its need for people with his qualifications, and hence his chances of promotion, its salary scale, and its other facilities, such as location or employer-employee relationships. The importance he attaches to each of these factors will depend on his individuality and temperament. How do they apply to the pottery trade?

The table and ornamental ware section, in which more than half its 70,000 workers are employed, has a special appeal to those interested in making things whose sale depends largely on quality and design. Students of physics and chemistry may also find attractive other aspects of ceramic production, especially that of electrical porcelain.

The long-term prospects for pottery are bright. For each of its main products—table and ornamental ware, glazed tiles, sanitary ware, and electrical porcelain—world demand has grown and is likely to grow further. Output as a whole should increase with the lowering of world tariffs, since foreign duties are high, while the protection accorded to British pottery (notably table ware) at home is almost negligible.

For many years to come British Governments are likely to encourage an industry with substantial oversea sales, especially in hard currency areas. British pottery exports amount to £20m.-£25m. a year, about half the total output. Furthermore, ceramic products depend hardly at all on imported raw materials, so that the gross total of exports can be virtually regarded as a net gain.

The Modern Outlook

Before the Second World War, it was claimed with some justification that this industry was backward. In the past 12 years, however, much technical and artistic progress has been made. A number of firms have introduced up-to-date methods of research, staff management, work study, cost accounting, stock control, salesmanship and merchandising. They also employ many fully trained artist designers. This trend will continue, so that there is likely to be an increasing number of openings for qualified people of all sorts. Moreover, several companies with large export businesses have established oversea branches, notably in North America. Here also there should be openings for well-trained young men prepared to live abroad.

It has been widely believed in the past that the prospects of advancement in pottery are not good because of the prevalence of the family business, where promotion goes solely to those with the right surname. This contention is ceasing to be vaild. The managements of most of these concerns have now realized that profits and even solvency depend on the selection of the right people for senior positions. In almost all firms there is plenty of room on the board of directors for those who are not members of " the family ". The number of potteries where a majority of shares remain in the hands of a small group is also diminishing. This is due to the incidence of estate duty and the popularity of public issues.

There are few industries where the set-up is more favourable to the energetic man of good ability who starts his own businees. Here there have been several cases of outstanding success in recent years.

In the past, the master potter has had the reputation of being a poor salary payer. Here, too, a change has taken place, due to the need to employ more highly qualified people in positions of responsibility in the face of national and local competition for their services.

Although there are many excellent potteries outside the city of Stoke-on-Trent, about 90 per cent. of them are concentrated in or near the city. It is, therefore, in this district that a candidate entering the industry might well have to pass much of his life. Grim pictures of the " Five Towns " (in fact, there are six) have been painted by authors and artists. They are regarded as the " Black Country ", cold, wet, smoky, mean and dirty, full of slums and empty of culture.

In fact, the climate is no worse than in any other part of the North Midlands. Electric, gas and oil-fired kilns are displacing the old-fashioned coal-burning " bottle oven ", thus diminishing factory smoke. Twelve years of a prosperity that is likely to continue and of an energetic building programme are transforming the city. Stoke-on-Trent is less and less the drab and dingy place of which Enoch Arnold Bennett wrote.

Staffordshire now has its own University College. The city and industry have expanded their technical and art schools. There young people will find good facilities for part- or full-time education in any subject likely to be useful to them in their careers.

Stoke-on-Trent offers advantages not easily found elsewhere. The city lies within a few miles of some of the most beautiful country in the Midlands. Its people are famous for their friendliness and hospitality. Descended from many generations of craftsmen, they are full of pride and affection for their personal work and for its end-product. Relations between employer and employee are as good as, if not better than, those anywhere else in the country. Strikes and lock-outs are virtually unknown.

The industry offers a warm welcome and a pleasant, interesting and useful career to any young man who decides to enter it.

27

THE INDUSTRIAL DESIGNER

BY

Sir Gordon Russell

DIRECTOR OF THE COUNCIL OF INDUSTRIAL DESIGN

So great was the prestige of British engineering products in the nineteenth century that they sold in spite of the fact that the convenience of the operator or the special requirement of the market often received insufficient consideration. So great was the prestige of English homes that it proved possible to sell for many years reproductions of the furniture, silver and textiles they contained. The First World War shook these notions; the second made them totter. The result is that there is today a rapidly growing interest in imaginative design.

The profession of industrial designer, covering a wide range of subjects—textiles, furniture, glass and china, and products of the light engineering industries in metal and plastics—offers great opportunities to well-trained men and women of the necessary high calibre.

Courses in design

I say " well-trained " advisedly, because the divorce of art and technical education has in the past made it difficult to train the industrial designer properly, and any rapid expansion of those schools where it is taught efficiently is hampered by lack of teachers. In addition to the art schools in London and the provinces, where students may apply for entrance on leaving school, the Royal College of Art in London, the only art school of university status in England, has departments for various aspects of industrial design. Although most schools receive a large number of applications, they find it difficult to get students with a wide enough general education. Many of the best students from secondary and public schools go into science because it is well publicized as an assured career, whereas schoolmasters know little of the prospects offered by industrial design, and what they do know often dates back several years to a time when prospects were very different from what they are today.

So far as product design is concerned, there are only four art schools in England offering this training, in addition to the Royal College of Art. Here the entrance position differs from that in other subjects, for all the schools, including the R.C.A., will accept the intelligent sixth form boy or girl, preferably with a good pass in Advanced G.C.E.

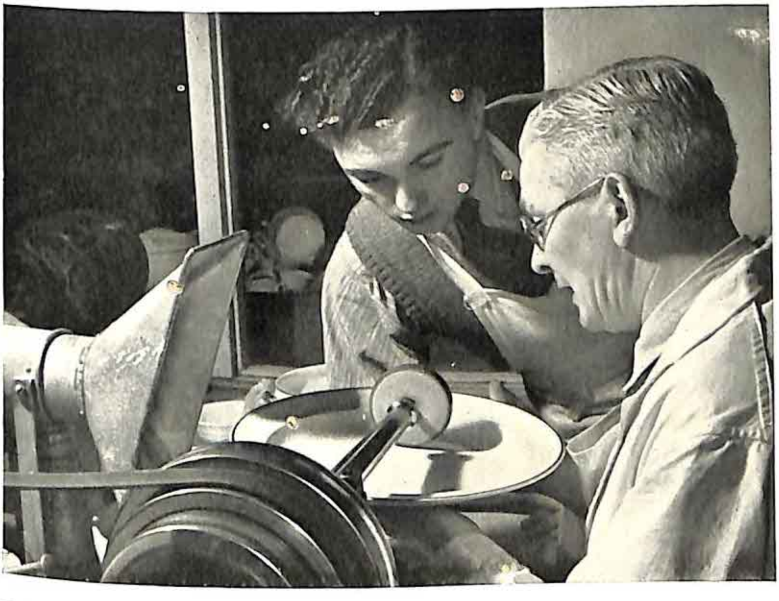
In all schools training is, broadly speaking, the same—a first year on basic design, followed by three years of specialized training in the chosen field. All schools encourage their students to visit factories and, where possible, to find appropriate vacation work. Many teachers are themselves practising designers, and this gives the students invaluable insight into the problems a practising designer must face. No school can teach a student how to explain a design convincingly to widely differing boards of directors. This can only be learned by experience, but at least the importance of this side of his work should be pointed out. The aim of all good schools is to make the student analyse his problem, visualize its solution by making a model or prototype, and if possible to see it carried out using the methods of production used in industry. The art school course normally leads to the Ministry of Education's National Diploma in Design (N.D.D.) and, in some cases, also the the school's own diploma, and the Royal College course (which often follows N.D.D.) to the qualification Des.R.C.A., awarded only after a further nine months in industry.

Experience and prospects

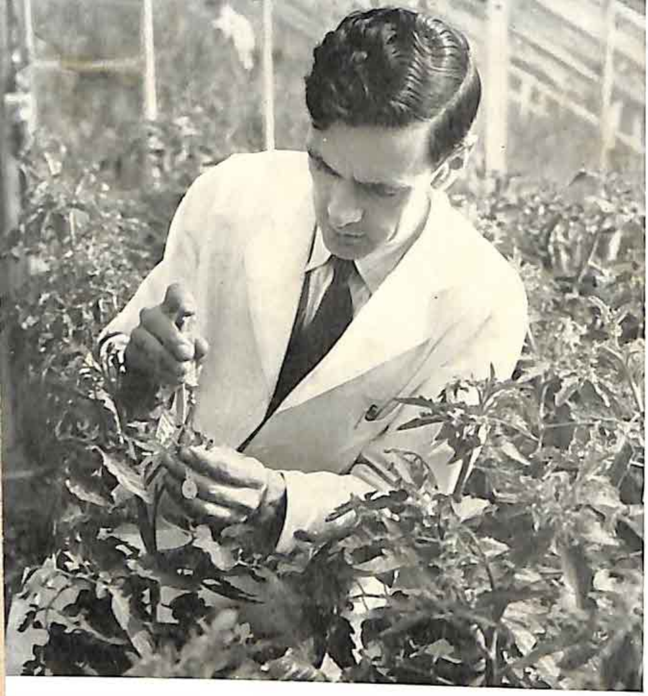
When a student has qualified, he will generally spend several years in industry, where his first salary will probably range between £400 and £700, depending on his training and ability. After this, he will be well advised to get a job, at least for a few years, with an established design consultant. At present such jobs are not difficult to get for the intelligent and creative designer, for there is a lack of good assistants—a lack which is likely soon to be more acute owing to the rapidly growing interest in design. In such a post he might expect to receive from £750 upwards, according to the standing of the consultant and his own ability. An experienced senior designer would expect to get two or three times this amount. On qualifying he will be well advised to register his name on the Council of Industrial Design's Record of Designers, which is now the most comprehensive in the country. The Council last year received more than 700 inquiries from firms for designers for particular jobs and positions. He should also apply for licentiateship of the Society of Industrial Artists, the only professional body for both industrial designers and commercial artists.

In due course, if he has the ability and drive to run his own studio, he may, after some years as a staff designer or assistant, set up for himself. There are too few first-rate design consultants —that is, people who are imaginative, knowledgeable, tactful, of good appearance and address, and efficient. All these qualities are important. The student who drifts round in an open shirt and dirty shoes naturally will not cut a lot of ice with the average firm. But for the trained man or woman who is not afraid of hard work and is capable of learning all the time, an industrial design practice has many advantages. It will be hectic and infuriating occasionally, but it will present so many different problems from day to day that it will never be dull or boring. And now is a particularly interesting time to join it, for there is no doubt at all that it is going ahead rapidly in Britain. A young man or woman can thus feel the zest of pioneering in a new occupation which is gaining prestige every year.

22. A girl printing with a silk screen at the School of Textile Design, Royal College of Art



23. Polishing the surface of flatware after it has been fired



24. Testing new growth substances on tomatoes at Long Ashton Research Station

25. An aircraft model at the National Physical Laboratory being checked before a compressed air tunnel test

28

THE RETAIL TRADE TRANSFORMED

BY

James B. Jefferys

GENERAL SECRETARY, INDUSTRIAL ASSOCIATION AND DEPARTMENT STORES

The main appeal of retailing as a career lies not in the present but in the future. At present there are too many prejudices against the retail trades. Retailing is often considered a parasitic aspect of our modern economy, adding unnecessarily to the cost of goods once they have been produced; a process organized on a small scale and using techniques that are unscientific and traditional; an occupation involving long hours of work and low pay. In fact, as a career it is seen as the last resort when everything else has failed. Are these prejudices justified and what scope and opportunity will there be in retailing in the next two decades? Let us look at some of the facts.

Streamlined methods

Big changes have taken place in the retail trades in the past 10 years, and these are but the beginning of a radical transformation. In selling methods there has been the development of self-service and self-selection, a system that has entirely changed the relationship between the retailer, the customer and the merchandise. In management organization, not only have some very large firms emerged, but also voluntary wholesale chains, which link together a large number of independent retailers and wholesalers for joint buying and rationalization of distribution. In techniques, work study has been used to analyse, simplify and improve the procedures of handling, stocking and selling merchandise. Shop and store design have been revolutionized by look-through windows, hot air curtains and the concept of taking the street into the shop.

Yet these and many other developments and ideas of the past decade are only a beginning, affecting only a minority of firms. Inevitably the new ways will spread to the majority of retailers in the near future. And further changes are just round the corner. For example, recording sales data on magnetic tape with point-of-sales recorders, the use of electronic brains for sales analysis and of their "memories" for re-ordering merchandise, widespread installation of automatic machines for selling goods at all hours, giant supermarkets stocking almost everything from food to hardware and hosiery, new shopping centres away from congested high streets, shops without walls, the application of operations research techniques to solve problems of optimum stock holding in given lines or the allocation of sales staff according to fluctuations in customer traffic, and so on.

The outstanding fact, then, about retailing as a career is that today it offers a tremendous opportunity for those who wish to take part in the transformation of a trade from traditional, handicraft methods to those that are streamlined and scientific.

Entry

The work itself, conditions of entry, promotion prospects, training, and pay in a trade as diverse as retailing are immensely varied. But certain generalizations can be made. The main jobs are buying, selling (including lay-out and display), store management (including building), traffic handling, office management and accounting, and staff. Whether all these and the sub-divisions of functions under them are specialized will depend on the size of the firm, but in any medium or large firm nearly half the staff work behind the scenes.

The qualifications required for some posts are technical (for instance, accountancy), but for the majority the main requisite is an interest in people and in merchandise and an orderly mind. One cannot succeed in retailing without an ability to select and arrange facts from the thousands of events that happen every day in a shop or store.

The main entry streams are those of 16-18 years and 20-25 years: roughly the school leavers and those who have had higher technical or university education. In almost every instance, as a part of training, new entrants " begin at the beginning "—behind the counter. But in most firms there is a carefully planned training scheme, often involving changing jobs, to ensure that new entrants get a grasp of the manifold tasks involved in retailing. The training period varies from about three months for some school leavers to 18 months or two years for university graduates.

Apart from the training within the firm, there are many educative courses run by trade bodies or local authorities. Most of the main trades, such as grocery, drapery and furnishing, have their specialized courses. In addition, there is the National Retail Distribution Certificate, which is taken after a three-year part-time course. This certificate is becoming more and more the prerequisite for a successful career.

Promotion and salary

So far as promotion and career prospects are concerned, the retail trade in Britain is nearly unique in that promotion comes largely from within. One large retail firm has the stated policy: " We grow our own people ". This induces loyalty to the firm, but it does not follow that promotion is simply by seniority. Facts and figures quickly show where ability lies in retailing, and managements promote on ability. They have to, as retailing is highly competitive. For able people career prospects are very good and promotion is rapid.

Finally, salaries. These again vary, but the competition to attract able men and women means that there is little difference in pay between retailing and other trades. Junior executives can expect £500-£700 a year on entering and when learning their jobs, rising to £2,000 if successful. In addition, for most posts there are bonuses and incentive payments. The salaries for higher management rise well above £2,000.

For specific information on posts and entry into retailing, the personnel officers of all large retail organizations willingly give assistance. Many of the trade associations, such as the Retail Distributors' Association (for department stores), the Multiple Shops Federation and the Drapers' Chamber of Trade can give perspectives on trades as a whole. The local Chamber of Trade in any town can also assist.

From its varied and diverse character retailing thus offers a good career and satisfaction for people of many different talents —in a small shop or in a giant multiple organization, in buying hats or in selling refrigerators. But, above all, a career in retailing in the coming decades offers the opportunity of taking part in transforming an essential industry.

29

JOBS IN FOOD PROCESSING

BY

R. S. Worth

PRESIDENT OF THE FOOD MANUFACTURERS' FEDERATION INC.

Any boy or girl who reflects on a choice of career over breakfast might be struck by the thought that a great many of the products on the table are manufactured foodstuffs. If he or she pursues this thought systematically at the rest of the meals during the day, the importance of food processing should become more and more apparent.

Enormous advances have been made in the manufacture and preservation of food. Fifty years ago it was in its infancy. Today it is one of the principal industries in the country and is still expanding on a considerable scale. It is lively and progressive in new techniques, and is now composed of many widely differing kinds of processes, all concerned with preparing and packaging a great variety of agricultural and fishery products, and distributing them so that they are readily available to everyone in this country and oversea.

No brief definition can serve to describe the structure of the British food industry. The firms that constitute it follow the usual size pattern: of the hundreds of companies, many employ several thousands and a greater number have several hundred employees.

Variety of Work

The processing of food calls for considerable technical competence in engineering, chemistry, physics, bacteriology, statistics, accounting, sales research, selling, advertising, transportation, work study, materials handling and various other functions. Thus it needs far more graduates both in science and the arts and people with professional qualifications than is generally realized, but there are plenty of opportunities for those who are not so highly qualified.

What sort of problems arise in an industry that is so diverse, but which supplies one of man's essential needs? The simple answer is that the processing of food offers the same challenge to management as exists in other industries. With the increasing application of science to processing there is a vital need for technologists of all kinds, who will find ready employment in it. Modern science is having its full impact; new and exciting ideas are being investigated by research scientists and engineers. Many more imaginative young men will find rewarding and progressive careers if they are prepared to bring to the industry their serious intention to contribute brains, integrity and a recognition that in so doing they are contributing to the health and nutrition of mankind.

Training after entry at " O "; level

Numerous firms encourage and give financial help to young employees who desire to continue further education by providing opportunities for day-release and sandwich courses at technical colleges and for attendance at the National College of Food Technology. The steady progress of the National College, established in 1952, which provides a two-year diploma course in food technology, post-graduate courses and a new four-year sandwich course, indicates the emphasis given to education for and within the industry. Appropriate courses for management training are also used, sometimes within the company by its education and training department, sometimes by attendance at external courses. There is a growing recognition by progressive managements in food manufacturing of the contribution that competent technical and professional people can make today. Greater opportunities for such careers will occur in the immediate future. Some food companies have regular contacts with careers masters at grammar and public schools, Youth Employment officers and the Public Schools Appointments Bureau. Their purpose is to attract holders of G.C.E. " O " and " A " level. Girls with G.C.E. " O " level are offered secretarial and clerical posts and, if they show a mathematical ability, they may eventually undertake market research and statistical work concerned with selling the product, or perhaps become supervisors in accounting and clerical departments. Women with the necessary qualifications are being increasingly employed in laboratories and in other functions concerned with quality control work, as well as in production management.

Boys with G.C.E. " O " level are recruited to gain experience in such fields as production planning, work study, laboratories, purchasing, marketing, advertising, sales research and export. According to their aptitude they are encouraged to continue their education and may be given opportunities to pursue professional studies of one kind or another.

Prospects for those with " A " level

Older boys with G.C.E. " A " level are normally recruited in a similar manner, but with " A " level their prospects of ultimately gaining higher qualifications, whether scientific, technological, or commercial, are very much brighter. They start with the essential standards, for example, for sandwich courses at technical colleges or for acceptance by the National College of Food Technology, and in some instances they may be exempt from the preliminary examinations of some professional institutions.

This is a very brief glimpse of the qualifications and methods of entry available for boys and girls from grammar and public schools. The best of them will almost certainly play a large part in the ultimate management of their respective companies. The speed and degree of their progress will very largely depend on themselves, their character, integrity, energy, imagination, and other attributes essential for successful management and leadership.

Graduates

University graduates in science and the arts and those with professional qualifications in the fields of engineering, science, and accounting are also required. Some firms have adopted management trainee schemes to attract graduates or young commissioned officers, generally between the ages of 24 and 30 years. Young men with Higher National Certificates or Diplomas, which usually imply some practical experience, are in great demand. There are also management opportunities for the non-scientist graduate, whether it be in economics or the arts. Some of these may find their niche in staff work, advertising, legal spheres, selling or sales research, both at home and oversea, or in the important field of buying raw materials from home sources and from all over the world. Again their progress will depend on their personal qualities, but opportunities exist for them to fill positions of responsibility.

The food processing industry is of essential importance to the community and provides a wide variety of careers. Increasingly it is attracting people of character, education, and ability.

30

SELECTION FOR RESEARCH ESTABLISHMENTS

By a Special Correspondent

The Scientific Civil Service as it exists today came into being at the end of the Second World War, after the issue of the Barlow Committee report and a Government White Paper. The service then created has proved adequate to deal with the scientific problems of vast complexity, many of them unknown in 1946, that have presented themselves in the rapidly changing post-war world. There are now some 100 scientific establishments controlled by the different departments of State, concerned with almost every aspect of research and development in pure and applied science. This article gives some idea of the opportunities offered to the scientist and of his general conditions of employment, though it is impossible to do more than touch on the important aspects of a large and complex organization.

Recruitment to most posts is by open competition conducted by the Civil Service Commission, of 6, Burlington Gardens, London, W.1, who can supply any further information. Such posts are established, that is, they are permanent and carry a non-contributory pension. There are also some that are unestablished, carrying identical salaries but no superannuation benefits. These posts are filled by the department concerned.

Selection for the three scientific classes is by interview. The Scientific Officer class is the senior, recruited in the main from first and second class honours graduates. For the usual entry grade candidates must normally be between 21 and 28. Older candidates (normally between 26 and 31) may be recruited as

Senior Scientific Officers; they are required in addition to provide evidence of post-graduate experience in appropriate technical work. To them falls the duty of initiating new research, and of directing the course of investigations already under way. This means that technical administration is bound to play a part in the life of a member of this class, particularly in its more senior ranks, but opportunities for individual initiative and original thought remain throughout his working career. Promotion is by merit, and prospects are good. A scientific officer of proved ability will reach the Principal Scientific Officer grade (London salary scale £1,450-£2,050 a year) in his early thirties. Beyond this rank there are good prospects of advancement to higher posts.

The Experimental Officer class provides the main helpers of the scientific officers. Its members are engaged on the more straightforward aspects of a particular research project, and the senior among them may well carry considerable technical responsibility for a particular section within a larger whole controlled by a scientific officer. Some may be university graduates; others may have qualifications of a more strictly technological kind through a National Certificate course; while a third group enter direct from school immediately after their " A " level certificate examinations.

Supporting the work of each of these classes is the Assistant (Scientific) class. The assistant is required to have school education to " O " level G.C.E. standard.

Of particular interest is the work of the Department of Scientific and Industrial Research, which emphasizes research for civil needs rather than defence and encourages research and application of scientific knowledge in industry. It is carried out partly through some 16 directly administered experimental stations, and partly through financial assistance to 40 cooperative industrial research associations. The subjects studied include ion exchange chemistry, lubrication, loose boundary hydraulics, ionospheric studies, aerodynamics, and design of electronic computers. Other research projects aim to deal with some pressing problems of everyday life—food preservation, building methods, water pollution, road construction, and road safety. One recent example of work undertaken directly to help industry was in the field of chemical research. A scarcity of sulphur some seven years ago led to anxiety about sulphuric acid production; research therefore began into the possibility of producing sulphur by bacterial action. This investigation was fully successful, and has reached the engineering stage in which sulphur can be produced on a large scale from sewage sludge. This process has the advantages of cheapness and independence of imported raw materials.

Other large employers of research workers are the Admiralty, the Ministry of Supply, and the Ministry of Agriculture, Fisheries and Food. Research work in the Defence departments naturally includes much direct work on weapons, but it also covers a great width and variety of research on astrophysics, radio-astronomy, solid state physics, gas thermodynamics, flame research, micro-wave techniques, infra-red spectroscopy, low temperature physics, and underwater acoustics. Among the most important studies by the Ministry of Agriculture, Fisheries and Food are those of virus diseases of animals and plants. The smaller Government departments add further variety to the list. For instance, much of the research work of the Nature Conservancy is aimed at problems of soil conservation and proper utilization of land. The evidence that is being slowly accumulated may have important effects on future agricultural policies in this country.

Although we are here considering careers in scientific research, it should not be forgotten that development is the natural partner to research and is of vital importance to this country. Development work in Government departments offers a wide range of posts to people qualified in all kinds of engineering. Taken together, Government departments can offer an enormous variety of research and development activities to interest both scientists and engineers.

31

NEW FIELDS FOR BANKING SERVICES

BY

O. E. Wood

CHIEF GENERAL MANAGER, MIDLAND BANK LTD.

The idea that banking is a safe but not very interesting job dies hard. Far from being only " an occupation providing a competence for the careful and a pension for the persevering " it provides a stimulating variety of opportunities in its diverse and widespread organization. Banking itself has undergone many changes of recent years. More and more of the purely routine operations are now handled mechanically and this, coupled with the extension of banking services into many new fields, means that work of interest and importance is placed in ever younger hands. The great banks have branches throughout the country. A man may during his career work in various offices with widely differing backgrounds of business, *e.g.*, farming, industry or finance, or oversea trade, and each will provide fresh interests, broadening his experience and developing his personality.

It is in this context of expanding opportunity and early responsibility that banks nowadays tackle the problems of recruitment and training for promotion. Apart from a limited number of graduates, the main stream of entrants is still from the public and grammar schools. An all-round General Certificate of Education at Ordinary level is essential, but of equal—or even greater—importance are the candidate's personal qualities. Banks know that their prosperity is founded on public confidence, which probably comes less from balance-sheet strength than from the impression made on customers daily by the manager and staff working in the local branch. With our reputation in so many hands we must choose and train staff with particular care. What you are is just as important as what you do.

Though the methods of the various banks differ in detail they all provide some form of basic training at entry. This is supplemented later on by specialized courses—frequently residential—in the more advanced stages of bank work. As capabilities are proved, experience in different fields of bank work is given, and promising men are often sent to outside business courses. In this way every opportunity is taken to foster at as early an age as possible the qualities required for managerial, administrative and executive posts.

What are the prospects for the new entrant today? When he has made the best of the training facilities, when he has built up his experience, and meanwhile passed the Institute of Bankers' examinations, he should be ready for the promotion he has striven for. Never have his chances of obtaining it been brighter. The banks are in general facing the loss by retirement over the next 10 or 15 years of a high number of senior men and this is one of the reasons why the " climate of opportunity " in banks will be exceptionally favourable for years to come.

In my own bank, for example, a substantial proportion of the men now entering its service will achieve managerial status at a salary ranging from £1,300 to £3,000 a year or more (and at a much earlier age than formerly), and opportunities as good or better are available in the specialized field of foreign business and in executor and trustee work. Beyond these positions are many others of an administrative or executive character carrying salaries up to £5,000 a year. Nor is this the limit for the really outstanding few, for from them will be chosen the men forming the bank's team of general managers. There is equal opportunity for all, and at no time and at no stage are there artificial or arbitrary barriers to impede outstanding ability.

Such are the prospects. It naturally requires energy, initiative and purpose to realize them—but there can surely be few careers today which offer young men of character and intelligence a better balanced combination of long-term security, and early and mounting opportunity.

32

QUALITIES NEEDED IN INSURANCE

BY

Charles F. Trustam

CHAIRMAN OF THE BRITISH INSURANCE ASSOCIATION

What are the qualities and qualifications necessary for a successful career in insurance? There is a ready and facile answer: intelligence, a good education, and a good personality. But that is a broad and comprehensive generalization which could fit, without any particular significance, the requirements of any but the most specialized work. A conscientious assessment of what is required calls for a critical appraisement of the work contemplated, of its essential nature as distinct from its more obvious manifestations. What are the fundamental characteristics of insurance?

First and foremost, insurance is a business. It is intimately concerned with our private, industrial, and commercial lives. We are dealing with people. It may be a householder in a great city or in a small hamlet in our quiet countryside; it may be the head of a mammoth industrial concern; the farmer in the Australian outback or the remote interior of America, Canada, India, or South Africa; with the financier, the lawyer, the scientist, or the politician. Few of us have to deal with them all; most of us have contact with some. An essential requirement, therefore, is the ability to get on with people; the qualities of the extrovert, the broad sympathy with and understanding of the varied characteristics that make up human society throughout the world.

But that is not enough. Too often it is said " I like people: I ought to do well in insurance ". Insurance is not merely a business:

it is a technical business. Personality is no good without knowledge. And as insurance touches almost every facet of commercial and industrial life we must be able—without any pretence of being experts in specialized fields—to discuss intelligently the insurance requirements of any and every part of the industrial and commercial activities of our time.

So we begin to get a picture of what is required of the new recruit into insurance: a personality that can come to terms with all kinds and conditions and nationalities of man; and an intellect, not necessarily scholarly or academic, but which nevertheless can speak with understanding to the financier and the lawyer, the manufacturer and the merchant—in brief, the well rounded personality with a first-class intellect that is catholic rather than specialized in its interests.

I have been frequently asked whether a special aptitude for mathematics is essential to the candidate for an insurance career. The answer is " No—not necessarily ". The essential is to have a well-trained mind and it is relatively unimportant what subject has been studied in attaining the necessary intellectual discipline. Mathematics or science, languages or literature, law or finance, statistics or surveying; there is ample scope for every shade of interest and training in the broad sweep of insurance activity.

The question of qualifications

Another common question is whether a boy should leave school immediately on attaining the requisite standard in the General Certificate of Education, or whether his chances of future success are enhanced by remaining at school and taking full advantage of the facilities for advanced education that are available today. The answer rests entirely with the boy. Broadly speaking, the insurance market has a place for all: for the young schoolboy, for the sixth former, and for the graduate. Over the years it has been our aim to recruit a representative cross section, and if we are to maintain that standard our intake must obviously reflect the changing educational pattern with its increasing tendency towards higher education. No advantage attaches to the graduate purely from the possession of a degree; any advantage lies in the enhanced ability he may be able to demonstrate through the intellectual discipline acquired.

Responsibility and promotion

And what of the future? The structure of insurance is basically democratic; there is no privileged class of recruit. Promotion is from within, and the administrators and managers, the underwriters and claims investigators, the legal and financial experts of tomorrow must be found from among the recruits of today. In a business with an unusually high ratio of management positions to total employees the opportunities for a young man of integrity, quietly confident of his own ability, are as attractive as they are challenging.

I have tried to avoid as far as possible the use of those overworked abstract words "job satisfaction" and "success", because in my experience they mean different things to different people. If by the former is meant the satisfaction of the need inherent in each of us to be assured that our job has a communal and social purpose, then insurance does provide job satisfaction. As for success, this is something that for most of us is not unrelated to salary levels. These follow a broad progressive pattern with wide variations according to the degree of responsibility. For the rank and file they are at least as good as can be obtained in any comparable employment; this obviously must be so if we are to recruit and retain our staff.

Looking farther ahead—and remembering that the insurance business covers not only this country but virtually the whole of the free world—there are many and varied opportunities for real ability; opportunities for promotion, for the carrying of higher responsibilities, and for reaping the rewards that go with them. Promotion may not be meteoric—after all, responsibility in a technical business does demand knowledge and experience; but it is by no means unusual for real merit to be recognized by the conferment of some degree of responsibility in the late twenties or the early thirties. The managership of a large branch office or a head office appointment of equivalent responsibility may carry a salary ranging up to £3,000, depending on the size and importance of the job, and for the higher executive posts there are greater prizes awaiting the really able.

But let there be no mistake, insurance does not promise a career of facile success. What it does offer is hard work of absorbing interest and broad opportunity. It is intensely competitive and fundamentally friendly. The promise, if promise there is, is the promise that is inherent in the young man himself.

33

LEARNING THE ART OF MANAGEMENT

BY

F. R. Livock

DIRECTOR OF THE BRITISH INSTITUTE OF MANAGEMENT

Whatever career a man undertakes, his ultimate aim is likely to be a position in top management. A career in management is not something separate and distinct from the other careers mentioned in this book; it is implicit in almost every one of them.

A man may start as an accountant, an engineer, a salesman; but, as he progresses in his career, an increasing amount of his time will be taken up with responsibility for the work of others. How can a man prepare himself for this responsibility? How can he acquire, early in his adult training, knowledge of management as an art and as a science?

Managers are the men who translate ideas into action. One thing is certain: the increasing complexity of industry, brought about by the technological advances of the past decades, will call for more men of management calibre. Those men will need to be more thoroughly trained in a wider range of knowledge and skill than their fathers were before them. As a speaker at a B.I.M. conference put it not so long ago, " we can no longer wait for managers to come up the hard way."

At the same time, it cannot be too strongly emphasized that the ability to manage depends very largely on inborn qualities of leadership. Those qualities cannot be planted there by a formal course of training, but there are many ways in which they can be developed once they are recognized. Similarly, though there may be many short cuts to knowledge, there can never be any substitute for first-hand experience. No amount of academic qualifications will alone turn a man into a manager. Yet, in addition to the necessary training in his own particular speciality, whether it is selling or finance or production, the younger man should acquire a knowledge of those subjects that will help him in the specific task of management. Facilities for this type of training already exist and are multiplying steadily. A young man would do well to make use of them if he is to take advantage of the opportunities that future years will offer.

Full- and part-time courses

One of the first tasks undertaken by the British Institute of Management on its foundation soon after the war was a survey of all the facilities for management training that exist in the United Kingdom. The last edition of this survey, *Education and Training in the Field of Management*, lists a total of 824 courses in management and allied subjects at 30 universities and associated colleges of technology, 252 technical colleges and nine adult educational centres. The number of these courses will continue to grow as demand increases both from students and from industry. Ten years ago the study of management as an academic discipline was almost unknown. Today more and more young men are taking part in management courses, and there is a growing awareness within individual companies of their importance to industry.

The British Institute of Management now administers, jointly with the Ministry of Education, a National Scheme of Management Studies leading to a certificate and a diploma. This scheme now operates at 94 technical colleges in various parts of the United Kingdom. The number of colleges working the scheme and the number of students passing through it have increased considerably in the past two or three years. In areas where there is close cooperation between the technical colleges and local industry results have been particularly satisfactory. There are encouraging signs that this cooperation is becoming more general. There is also a system of external examinations, successfully run for many years by the Institute of Industrial Administration, which became known as the B.I.M. Graduate Examinations when the I.I.A. was integrated with us just under a year ago. The number of candidates sitting for these examinations increased by 20 per cent. last year.

At a later stage in development there are courses for junior and middle management, designed to supplement working experience. These include short full-time courses at universities and other educational centres, the B.I.M. Executive Development Programme and the three-month course at the Administrative Staff College at Henley. In addition to advice on these and other courses, the B.I.M. also gives in its 30 branches an opportunity for students to associate with other young men who are making similar preparations for a career in management and, still more important, with successful older men who have already made their mark on industry. It also offers, through its conferences, its publications and its library, facilities for continuing study and exchange of information on those techniques with which the manager must be equipped for the tasks of tomorrow.

Whether a young man goes straight into industry after leaving school or enters as a university graduate, a great deal depends on the company he chooses. An enlightened company will plan for the management positions that need to be filled five and 10 years ahead. It will seek every opportunity of drawing out a talent for leadership and will carefully recruit young men at various levels of education to fit into its management development scheme. A scheme of this nature should provide the strongest attraction to a young man who is ambitious for a career in management. For it offers not only training courses within the company itself, many of which are of the highest quality, but also an encouragement to take part in outside courses and a planned rotation through the various departments designed to speed up the acquisition of the experience needed for management.

ADDRESSES WHERE FURTHER INFORMATION MAY BE OBTAINED WITH DETAILS ABOUT SOME OF THE NEWER OR LESSER-KNOWN COURSES

EMPLOYMENT AND ADVISORY SERVICES

Local Youth Employment Offices, Public Libraries and Education Authorities.

Public Schools Appointment Bureau, 17 Queen St., London, W.1; 19 Greengate St., Stafford and 4 St. Colme St., Edinburgh, 3.

University Appointment Bureaus.

National Institute of Industrial Psychology (Vocational Guidance Section), 14 Welbeck St., London, W.1.

PUBLICATIONS

'The Year Book of Technical Education and Careers in Industry' edited by H. C. Dent (A. and C. Black), 30s.

The Ministry of Education pamphlet 'Choice of a Career', published by Her Majesty's Stationery Office. Price about 1s.

'Directory of Opportunities for Graduates', 'School Leavers' and 'Qualified Men', (Cornmarket Press), each 8s. 6d.

Most industries and professions produce their own pamphlets which can be readily obtained on application.

PROFESSIONS AND INDUSTRIES

Accountancy

Institute of Chartered Accountants in England and Wales, Moorgate Place, London, E.C.2.

Institute of Chartered Accountants in Scotland, 27 Queen St., Edinburgh, 2.

Institute of Cost and Work Accountants, 63 Portland Place, London, W.1.

Aeronautics

Society of British Aircraft Constructors, 29 King St., St. James's, London, S.W.1.

Degree courses in aeronautical engineering at Belfast, Bristol, Cambridge, Glasgow, Imperial College (London), Northampton Polytechnic (London) and Southampton Universities.

Dip. Tecs. at Kingston Technical College, Northampton College of Technology (London), Royal Aircraft Establishment Technical College, Farnborough.

Courses to H.N.C. at Hatfield and Hull Technical Colleges.

Honours Diploma in Aeronautical Engineering at Loughborough College.

Residential course for students of graduate standard at College of Aeronautics, Cranfield, Buckinghamshire.

Architecture

Incorporated Association of Architects and Surveyors, 29 Belgrave Sq., London, S.W.1.

Atomic Energy

United Kingdom Atomic Energy Authority, 11 Charles II St., London, S.W.1.

Banking

Institute of Bankers, Lombard St., London, E.C.3.

Building

Institute of Builders, 48 Bedford Sq., London, W.C.1.

Degree course at Manchester University and Cardiff College, University of Wales.

Dip. Tec. (from Sept. 1959) at Birmingham College of Technology.

National Diploma courses at Brighton, Nottingham, North Gloucester (Cheltenham), Salford, Sunderland, and Willesden Technical Colleges; Birmingham, Bristol, Leeds, Manchester, and Sheffield Colleges of Technology; College of Building, Liverpool; Brixton School of Building (London) and Welsh College of Advanced Technology, Cardiff.

Chemical Engineering

Institution of Chemical Engineers, 16 Belgrave Sq., London, S.W.1.

Degree Courses in Chemical Engineering at Birmingham; Cambridge; Durham; Edinburgh; Leeds; London (Imperial College of Science and Technology, King's University); Manchester; Glasgow (Royal College of Science and Technology); Swansea; Heriot-Watt College, Edinburgh (Associateship).

A wide variety of courses at Technical colleges throughout the country.

Chemistry

Royal Institute of Chemistry, 30 Russell Sq., London, W.C.1.

Coal

The National Coal Board, Hobart House, London, S.W.1.

Mining Qualifications Board (Ministry of Fuel & Power), Thames House South, Millbank, London, S.W.1.

Degree Courses at Birmingham, Durham (Newcastle Division), Edinburgh, Glasgow, Leeds, Imperial College, London, Nottingham, Sheffield, Wales (Cardiff).

Electricity

Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2.

Electricity Council, Trafalgar Buildings, 1 Charing Cross, London, S.W.1.

Central Electricity Generating Board, Bankside House, Summer St., London, S.E.1.

Engineering

Institution of Civil Engineers, Gt. George St., London, S.W.1.

Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2.

Institution of Engineering Designers, 38 Portland Place, London, W.1.

Institution of Industrial Engineers, 86 Eccleston Sq., London, S.W.1.

Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1.
Institution of Mining Engineers, 3 Grosvenor Crescent, London, S.W.1.
Institution of Production Engineers, 10 Chesterfield St., London, W.1.
Institution of Structural Engineers, 11 Upper Belgrave St., London, S.W.1.

Food

Food Manufacturers' Federation, 4 Lygon Place, London, S.W.1.
National College of Food Technology, Laysterne School, Cranwood, London, E.C.1; and Eagle Court, St. John's Lane, London, E.C.1.

Gas

Institution of Gas Engineers, 17 Grosvenor Crescent, London, S.W.1.
Gas Council, Murdoch House, 1 Grosvenor Place, London, S.W.1.
Degree Course in Gas Engineering at Leeds University.
Courses in fuel technology at Imperial College of Science and Technology, London University.
H.N.C. (part-time courses), Brighton, Cardiff, Dundee, Enfield, Tottenham and Westminster Technical Colleges; Rutherford College of Technology, Newcastle; Bradford College of Technology; Royal Technical College, Salford; College of Technology, Birmingham; Royal Technical College, Glasgow and Heriot-Watt College, Edinburgh.
(Sandwich courses) Birmingham, Enfield, Salford, Westminster.

Glass

Glass Manufacturers' Federation, 19 Portland Place, London, W.1.
Degree Course in Glass Technology at Sheffield University.
H.N.C. (Sandwich course), St. Helen's Technical College.
Glassmaking and Decorating, Foley College of Further Education, Stourbridge.
First year course in basic glass technology, Doncaster Technical College.

Industrial Design

The Council of Industrial Design, 28 Haymarket, London, S.W.1.
Royal College of Art, South Kensington, London, S.W.7.
Course for National Diploma in Design at Central School of Arts and Crafts, London; Birmingham, Glasgow, Leeds and Leicester Colleges of Art; College of Art and Industrial Design, Newcastle; Society of Industrial Artists, 7 Woburn Square, London, W.C.1.

Insurance

British Insurance Association, 59 Gresham Street, London, E.C.2.

Iron and Steel

Training Department, British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1.

Management

British Institute of Management, 80 Fetter Lane, London, E.C.4.
Institute of Industrial Administration, Management House, Mill Street, London, W.1.
Institute of Industrial Managers, 86 Eccleston Square, London, S.W.1.
One year post graduate courses which include Industrial and Business Administration at Birmingham, Glasgow, London (Imperial College, and London School of Economics and Political Science) Universities; Loughborough College of Science and Technology.
Courses for Intermediate Certificate, Diploma B.I.M. and certificate course in Foremanship and Supervision held at many technical colleges throughout the country on part-time, evening, and sandwich basis.
Short residential courses given at Henley (for those with a number of years' experience) and at Wadham College, Oxford. Further information from British Institute of Management, Education and Training Advisory Service which covers this country and abroad.

Metalliferous Mining

British Overseas Mining Association, 8 Gt. Winchester Street, London, E.C.2.

Institution of Mining and Metallurgy, 44 Portland Place, London, W.1.

Degree Courses at Royal School of Mines, Prince Consort Road, London, S.W.7.

School of Metalliferous Mining, Camborne, Cornwall.

Metallurgy

Institution of Metallurgists, 4 Grosvenor Gardens, London, S.W.1. Degree courses at Birmingham, Bristol, Cambridge, Cardiff, Durham, Glasgow, Leeds, London, Manchester, Nottingham, Sheffield and University of Wales, Swansea.

Paper

British Paper and Board Manufacturers' Association, Melbourne House, Aldwych, London, W.C.2.

Degree in Paper Technology, Manchester College of Science and Technology.

B.Sc.Tech. at Manchester College of Technology.

Physics

The Institute of Physics, 47 Belgrave Square, London, S.W.1.

Plastics

The Plastics Institute, 6 Mandeville Place, London, W.1.

Courses leading to Diploma and Associateship of Plastics Institute (full-time), at Acton Technical College, Borough Polytechnic, London, S.E.1.; (part-time), at Brunel College of Technology, London; National College of Rubber Technology, London; College of Technology, Birmingham; Welsh College of Advanced Technology, Cardiff; Newton Heath Technical College, Manchester; Stroud and District Technical College, Stroud.

Courses leading to Graduateship (full-time), at National College of Rubber Technology, London; College of Technology, Birmingham; (part-time), at Borough Polytechnic, London; Brunel College of Technology, London; College of Technology, Birmingham; Royal College of Science and Technology, Glasgow; Newton Heath Technical College, Manchester; 4 years' sandwich course at Borough Polytechnic, London; Brunel College of Advanced Technology; College of Technology, Birmingham.

Radio and Electronics

The Institution of Radio Engineers, 9 Bedford Square, London, W.C.1.

The Radio Industry Council, 59 Russell Square, London, W.C.1.

Diploma of Technology in Radio and Electronics at Brumel College of Technology, Acton; College of Technology, Birmingham; Battersea, Borough, Northampton, Northern and Woolwich Polytechnics; Loughborough College of Technology.

Higher National Diploma with radio and telecommunications available at technical colleges throughout England; the College of Technology, Belfast; Glamorgan Technical College, Treforest.

Higher National Certificate courses also available throughout England, and at College of Technology and Commerce, Cardiff; College of Technology, Belfast; Royal Technical College, Glasgow; The Technical College, Swansea; Glamorgan Technical College, Treforest; Denbyshire Technical College, Wrexham.

Railways

Information from Regional and Establishment Staff Officer, British Railways at the following addresses: Eastern Region, Liverpool Street Station, London, E.C.2; Scottish Region, 302 Buchanan Street, Glasgow, C.2; London Midland Region, Euston Station, London, N.W.1; Southern Region, Waterloo Station, London S.E.1; North Eastern Region, York; Western Region, Paddington Station, London, W.2.

Chief Signal Engineering Officer, British Transport Commission, 222 Marylebone Road, London, N.W.1.

Research

Department of Scientific and Industrial Research, Charles House, 5-11 Regent Street, London, S.W.1, and 20 Walker Street, Edinburgh.

Retail Trade

International Association of Department Stores, 58 Rue Caumartin, Paris 9.

Multiple Shops Federation, Commonwealth House, New Oxford Street, London, W.C.1.

Retail Distributors Association, 168 Regent Street, London, W.1.

Shipbuilding

Shipbuilding Employers' Federation, 1 Chester Street, Grosvenor Place, S.W.1.

Institution of Naval Architects, 10 Upper Belgrave Street, London, S.W.1.

North East Coast Institution of Engineers and Shipbuilders, Bolbec Hall, Newcastle-upon-Tyne, 1.

The Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2.

National Association of Marine Engine Builders, 21 Grosvenor Place, S.W.1.

Degree course in Naval Architecture and Marine Engineering at Durham and Glasgow Universities.

Degree course in Naval Architecture at Belfast University.

Day and Evening courses in Naval Architecture to H.N.C. available at Colleges of Science and Technology and Technical Colleges throughout the country in or near centres where shipbuilding and ship-repairing are carried out.

Course for Diploma of Technology at Royal College of Science and Technology, Glasgow, and Sunderland Technical College.

Textiles

British Man-Made Fibre Foundation, 58 Whitworth Street, Manchester, 1.

Cotton Board, Royal Exchange, Manchester, 1.

Textile Institute, 10 Blackfriars Street, Manchester, 3.

Degree courses in technology at Belfast, Leeds and Manchester Universities; Royal College of Science and Technology, Glasgow.

Courses for Diplomas, College Associateship or City and Guilds of London Institute available at technical colleges throughout the country.

INDEX

Accountants, 13, 16, 27, 33, 73, 75, 76, 80, 100, 104, 108, 114, 118, 119.
Arts graduates, 15, 16, 18, 20, 24, 33, 47, 90, 115, 118, 119, 127.

Bacteriologists, 28, 118, 112.

Chemists, 10, 14, 15, 18, 19, 24, 27, 31, 44, 45, 47, 54, 90, 97, 99, 100, 104, 107, 118, 121.
Clerical work, 76, 119.

Designers, 58, 70, 80, 96, 100.
Draughtsmen, 31, 44, 70, 81.

Economists, 16, 20, 90, 100, 101, 120.
Engineers, 9, 10, 14, 18, 22, 26, 30, 40, 44, 47, 52, **56**, 62, 66, 71, 75, 79, 84, 92, 96, 100, 104, 118, 122.
  aeronautical, **84**, 122.
  chemical, **18**, 24, 27, 47, 92, 96, 100.
  civil & structural, 27, 56, 64, 66, 75, 84.
  electrical, 19, 24, 27, **30**, 40, **44**, 56, 75, 80, 100.
  electronic, **40**, 64, 80, 84.
  hydraulic, 67, 84.
  gas, 27.
  marine, 71.
  mechanical, 19, 24, 27, 44, **56**, 63, 75, 105.
  mineral dressing, 53.
  mining, 53.
Engineers: (cont.)
  nuclear, 62.
  signal, 75.
  telecommunications, 35.

Geologists, 14, 53.
Geophysicist, 14.

Industrial designer, 106, 108, **110**.

Lawyers, 16, 27, 120.

Market research, 80, 92, 119.
Mathematicians, 11, 15, 24, 30, 35, 47, 101.
Metallurgists, 10, 24, 47, **49**, 80, 82, 84.
Mining geologists, 53.

Naval architecture, 72.

Physicists, 10, 14, 15, 18, 24, 35, 44, 45, 82, 91, 96, 99, 104, 107, 118, 123.

Research, 10, 15, 19, 27, 35, 41, 50, 54, 80, 91, 99, 100, 105, 108, 118, 121.
Retailing, 113.

Sales, 15, 19, 20, 24, 28, 32, 80, 92, 96, 100, 108, 118, 120.
Shipwrights, 70.
Statisticians, 27, 101, 118, 119.
Surveyors, 14, 67.

Women, 20, 28, 33, 45, 85, 119.
Work study, 101, 108, 114, 118.

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